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Saving of 24 per cent shown by

Material Handling System

By Robert E. Kinkead

Chief Engineer, Welder Division, The Lincoln Electric Co.

THE problems of handling material effectively have been worked out with a considerable degree of thoroughness by The Lincoln Electric Co. at Cleveland, Ohio. The necessity for good engineering work in connection with material handling as well as other manufacturing problems is apparent in view of the fact that induction motors are selling at about 110 per cent of their 1913 prices while the prices of the raw materials and labor average nearly 200 per cent of the 1913 prices. Better manufacturing methods, better material handling, and the most up-to-date machine tools have more than absorbed the price deficit and leave a slightly larger margin of profit than was shown in 1913. The material handling problem in connection with the manufacture of induction motors is somewhat complicated when it is considered that from raw material to crated and finished product 570 handlings are involved. A material handling is counted every time a man picks up or lays down any part which goes into the finished product. On the average there is more than one move between material handlings. The moves are from operation to operation or to and from stock. The major parts move approximately four miles between receiving platform and finished crated stock. As far as possible, movement is in a straight line although the nature of the manufacturing process does not permit a very close approach to the ideal of "straight line production." Handling material by manual lifting or pushing

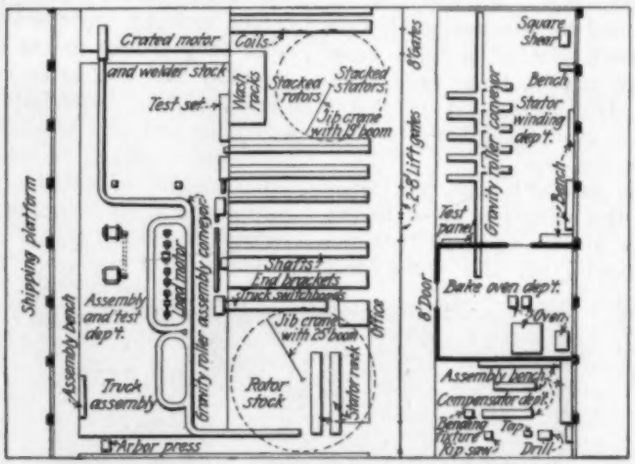


Fig. 1—Layout of part of the Lincoln plant for manufacturing motors and arc welders

Fig. 2—Section of conveyor system in winding room. This conveyor delivers the wound stators to the oven room where the waterproof insulation is applied

Fig. 3—Shipping room end of conveyor system showing finished motors arriving at shipping room on shipping skids ready for crating

has been practically eliminated except where small parts are put in or taken out of machines. Accomplishment of this result has been obtained by the use of electric storage battery tractors, truck platforms with steel boxes for small parts, bridge cranes, tram rails, conveyor system, jib cranes, electric hoists and incidental equipment. Special trucks are used extensively to handle heavy material between operations.

A particular feature of the special trucks, platforms and other handling units is the attention given to the matter of convenience. They are so designed that the average height of the material on the truck will come just below the level of a man's belt, thus enabling the operator to handle material to and from the truck with a minimum of effort. It is an established fact that a man comes to work in the morning with a perfectly definite amount of energy which may be expended. If a considerable portion of that energy is used up in merely lifting and shoving things around, his production output suffers in proportion to the unproductive effort required. The energy needed to lift twenty 100-lb. pieces a vertical distance of three feet is the equivalent of the actual amount of energy required to turn out a satisfactory day's production on practically any operation. Every effort is made to eliminate the necessity of a man expending his energy in a manner which does not yield production to the company or wages to the man. The saving has amounted to 24 per cent of the labor cost of the product in the last four years. This saving, credited entirely to better material handling methods, would not have been possible without the whole-hearted co-operation of the shop operatives.

The shop forces have made a good many of the special trucks by the use of electric arc welding. Standard structural shapes are welded together to produce a wide variety of special racks, truck bodies, etc., all with the idea of reducing the non-productive effort required by the operator. The cost of this equipment is very low so that it is scrapped without hesitation if a better design is suggested.

The illustration showing a section of the plant layout, Fig. 1, gives a good idea of the general movement of material through the Lincoln plant. Parts manufacture is carried on in the side bays. Manufactured parts are moved on lift truck skids into stock in the center bay. The parts are then fed onto the roller conveyor system and thence to assembly, test, crating and shipping departments respectively.

The auxiliary conveyor system in the winding room is shown in Fig. 2, while Fig. 3 shows the shipping room end of the main conveyor system. Fig. 4 shows a section of the main conveyor system in the test department. Fig. 5 shows a variation of the above-described general plan of parts movement. The engine-driven welding units are placed on the special welded-steel shop trucks in the stockroom and move through assembly and test to the shipping department on these shop trucks. A saving of 65 per cent in labor of assembly and test was effected by keeping the equipment on wheels from the stock room to the shipping department. In addition, the time required to get the equipment to the shipping floor from the stock room was reduced by 40 per cent.

The welded steel annealing platforms shown in Fig.

Fig. 4—View of motors passing through test department on conveyor system. Motors failing to pass test are shunted back to assembly on an auxiliary conveyor

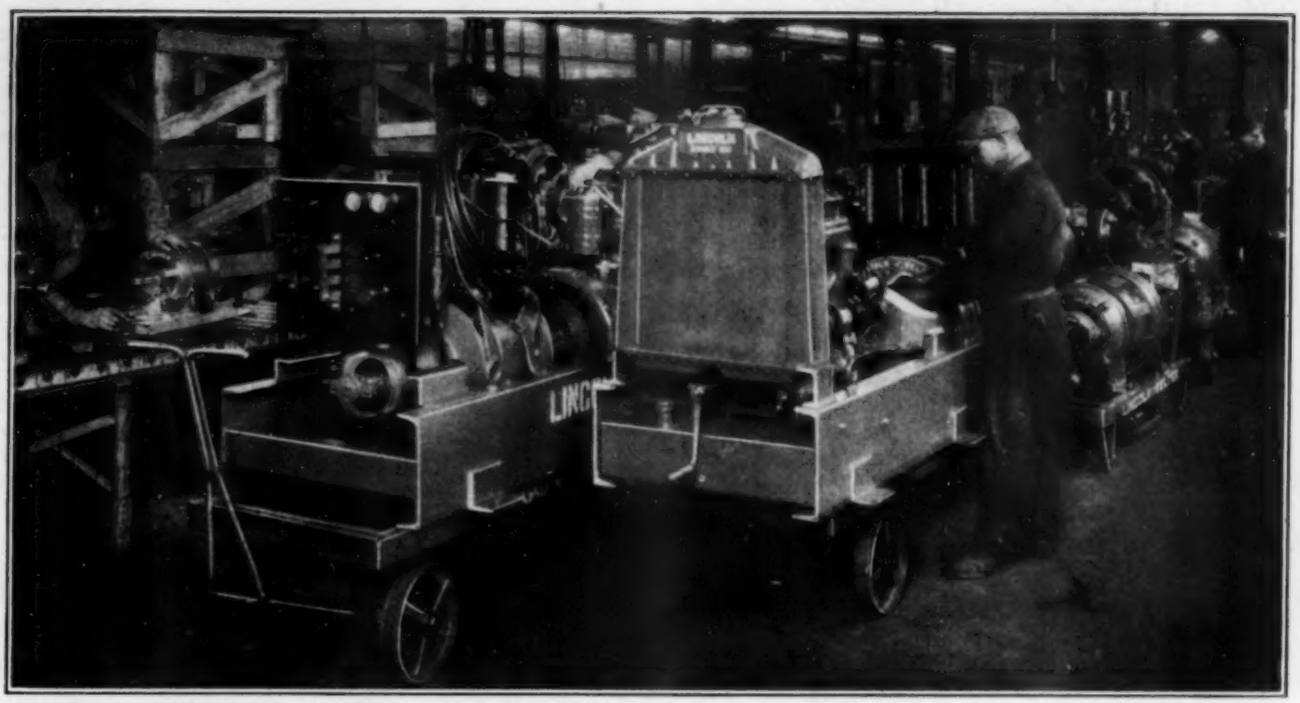


Fig. 5—Special arc-welded shop trucks used for assembly of engine-driven arc welders. The equipment is kept on wheels until it is crated for shipment

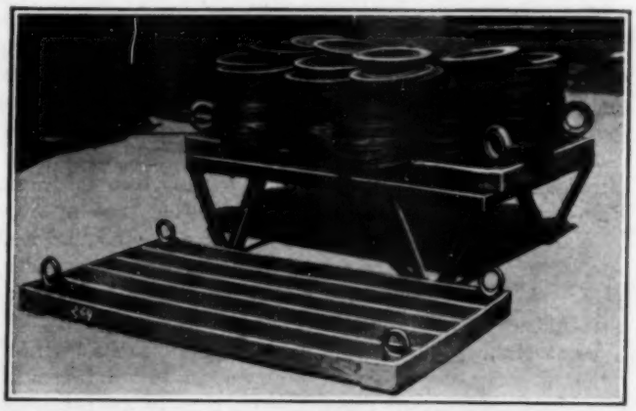


Fig. 6—Welded steel annealing platform for handling laminations direct from punch presses to annealing oven

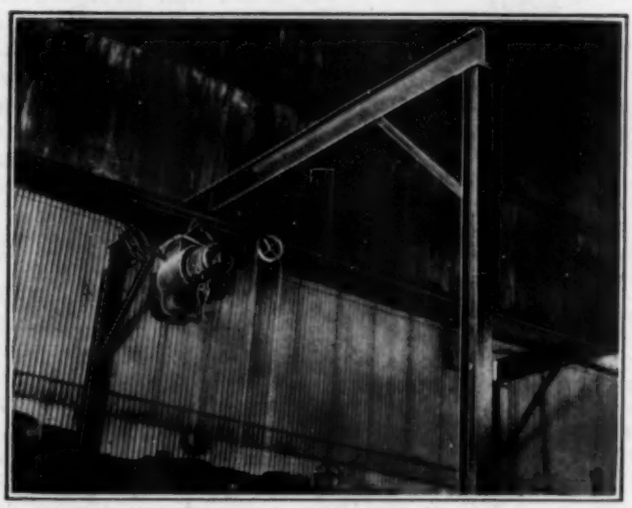


Fig. 7—Overhead structure for four-ton electric hoist erected by electric arc welding in place of riveting

6 receive the laminations direct from the punch press operator and are hoisted directly into the annealing furnace without extra handling. The use of light-weight low-cost welded-steel construction for these platforms in place of the usual cast-steel construction shows advantages in the matter of original cost, reduction of weight moved and heat economy in the furnaces.

The use of electric arc welding in material handling equipment is shown rather strikingly in Fig. 7 which shows an extension to the overhead monorail system erected by welding in place of riveting. Labor cost of the welded joints amounted to slightly less than 40 per cent of what would have been necessary had riveting been used for the same purpose.

The Inch—Discussion

By Sir Henry Fowler
Derby, England

ABOUT thirty years ago, I found in a book in the library of the Institution of Civil Engineers, a loose paper containing three verses on the same subject by W. J. M. Rankine, the well-known engineer and physicist, who died in Glasgow on 24th December, 1872.

I have unfortunately mislaid my copy of the verses, but still remember the following:

"The great Egyptian pyramid's a thousand yards about,
And when the masons finished it they raised a mighty shout.
The man who planned that building,
Be sure he was no fool;
And now 'tis proved beyond a doubt,
That he worked with a three-foot rule."

The concluding two lines of the whole poem were:

"By pounds I'll eat, by quarts I'll drink,
And I'll work with a three-foot rule."

I fancy Rankine must have antedated the archaeologist mentioned in the editorial on page 272, Vol. 66.

Limit Gages—Their Use and Application—Discussion

By T. F. Githens

IN REFERENCE to the article, "Limit Gages—Their Use and Application," by M. E. Harold, published on page 363, Vol. 66, of the *American Machinist*, I would suggest that the "standard" plug gage shown in Fig. 1 should be dimensioned as shown in the accompanying table.

These figures are taken from the "American Standard Tolerances Allowances and Gages for Metal Fits," published as A.E.S.C. Report B 4a—1925 by the American Society of Mechanical Engineers. The hole and running shaft tolerances are from the tables for Class 3 Fit, Medium Allowance, and the tolerances on the shaft for a drive fit are from Class 6 Fit, Tight.

The actual tolerances agree quite closely with those given by Mr. Harold. Their direction, however, is different. For example, according to him the 1-in. hole is $1\ ^{+0.0000}_{-0.0008}$, but according to the A.E.S.C. standard it is $1^{+0.0008}_{-0.0000}$. Both these tolerances are unilateral (in one direction), but in the former the maximum hole is basic and in the latter the minimum hole is basic.

The basic minimum hole is to be preferred for the following reasons:

1—It allows the use of a standard 1-in. plug gage as the Go gage, which is the one that is more often used, worn out, and replaced. A standard gage can be bought more cheaply and more quickly than one made to a special size.

2—Standard reamers can be used, as it is common practice for some of the large drill and reamer companies to finish their reamers a few ten-thousandths of an inch oversize to allow for wear. This oversize dimension should fall within the specified tolerance.

3—The actual "zero" or interference of metal line is always at the standard size; for example, for interchangeability, the smallest hole can not be less than 1.0000 in. nor the largest shaft larger than 1.0000 in. In the system given by Mr. Harold the zero or interference of metal is a variable amount below basic or standard size and no real interchangeability can be maintained if the tolerances are changed to suit production conditions.

In his table the tolerances given for the gages exceed the tolerances given on the hole. It is believed that it is better practice to make the work tolerance large enough to include the gage tolerances and wear allowances. If this is not done, actual tolerances change with the change in gage tolerances and lead to confusion. For example, the hole tolerances on the 1-in. hole is $1\ ^{+0.0000}_{-0.0008}$ or 1.0000 and 0.9992 in. The Not Go plug gage is 0.0002 ± 0.0001 or 1.0003 and 1.0001 in. This allows a maximum hole of 1.0003 in. The Go plug gage is — 0.001 ± 0.0001 or 0.9991 and 0.9989 in. This allows a minimum hole of 0.9989 in. Therefore the actual hole tolerances are not 1.0000 and 0.9992 in. or $1\ ^{+0.0000}_{-0.0008}$ but are 1.0003 and 0.9989 in. or $1\ ^{+0.0003}_{-0.0011}$. This is an actual tolerance of 0.0014 in. and should be located so that the hole dimension is $1\ ^{+0.0014}_{-0.0000}$ or 1.0000 and 1.0014 in. to obtain the advantage of the standard-hole unilateral tolerance system. The gages would then be, Go gage 1.0000 $^{+0.0002}_{-0.0000}$. Not Go gage 1.0014 $^{+0.0000}_{-0.0002}$.

Nominal Hole Size, In.	Hole Reaming Limit	Go Plug		Not Go Plug		Shaft Limit Running Fit	Shaft Limit Drive Fit
½	+0.0006 −0.0000	+0.0000	+0.0002 −0.0000	+0.0006	+0.0000 −0.0002	−0.0006 −0.0012	+0.0006 +0.0001
1	+0.0008 −0.0000	+0.0000	+0.0002 −0.0000	+0.0008	+0.0000 −0.0002	−0.0009 −0.0017	+0.0009 +0.0003
2	+0.0010 −0.0000	+0.0000	+0.0002 −0.0000	+0.0010	+0.0000 −0.0002	−0.0014 −0.0024	+0.0013 +0.0005
3½	+0.0012 −0.0000	+0.0000	+0.0002 −0.0000	+0.0012	+0.0000 −0.0002	−0.0021 −0.0033	+0.0018 +0.0009
6	+0.0015 −0.0000	+0.0000	+0.0002 −0.0000	+0.0015	+0.0000 −0.0002	−0.0030 −0.0045	+0.0026 +0.0015

Varying Brightness of the Work-Area Is Costly

WE LIKE to look up from our work in office and shop to rest our eyes against the sky or ceiling or deep shadow. An occasional change of this sort is good for them. However, it has been found by careful investigations that the efficiency of vision is greatly reduced if the eyes, in the process of work, must look alternately at areas differing considerably in brightness. For example, if the visual work requires the eyes to look alternately from a shadowed area to a fully lighted one, or from a dark to an appreciably lighter surface, visual efficiency is reduced; that is, seeing is less accurate, slower, and more fatiguing.

In an elaborate investigation one portion of a "white" or light gray surface was illuminated to an intensity of 5 footcandles and the other portion to an intensity of 20 footcandles. The eyes had to distinguish the same object alternately against the two backgrounds and as rapidly as possible. It was found that the speed of seeing or "production" was about the same as though the entire surface was illuminated to only 5 footcandles. Furthermore, the condition was annoying and fatiguing to the eyes. Thus it is seen that the illumination of a portion of the area to 20 footcandles is a waste if the eyes are also obliged to work alternately in the region of 5 footcandles. Practice is tending toward 20 footcandles and some factories are already employing as high as 50 footcandles. One of the lessons obtained from the foregoing is that shadows in the work-field may be very detrimental to efficient vision. In general a fairly uniform brightness over the area where the eyes must travel more or less is very desirable.

Locating the Stopping Points *of a* Precision Indexing Mechanism

Locating six points on the periphery of a heavy machine part to a degree of accuracy that would reflect credit upon a toolroom job

DIVIDING a circle 18 ft. in circumference into six equal parts within a limit of error of less than 0.001-in., plus or minus, is a job to which any toolmaker might point with justifiable pride, yet it is but a commonplace incident in the daily work of the men who build "Mult-Au-Matics" at the plant of the Bullard Machine Tool Co., Bridgeport, Connecticut.

This machine is designed to bore, turn and face any shape of forging or casting within its range of size that can be held in standard or special chucks at the business ends of vertically-disposed revolving spindles.

The work spindles take their bearings in a circular member, called the "carrier," that rotates intermittently around the central column of the machine, halting in six positions while the tools are at work.

The cutting tools are held in "universal" tool-heads having a primarily vertical movement in gibbed ways on the hexagonal faces of the column, actuated by gears and cams that are enclosed in a large case surmounting the column. The number of tool-heads is always one less than the number of spindles, leaving one face of the column open as a loading station. The operator chucks a piece of work at the loading station and the carrier transfers that spindle to the first working station where the tools of the corresponding head start upon their prescribed cycle.

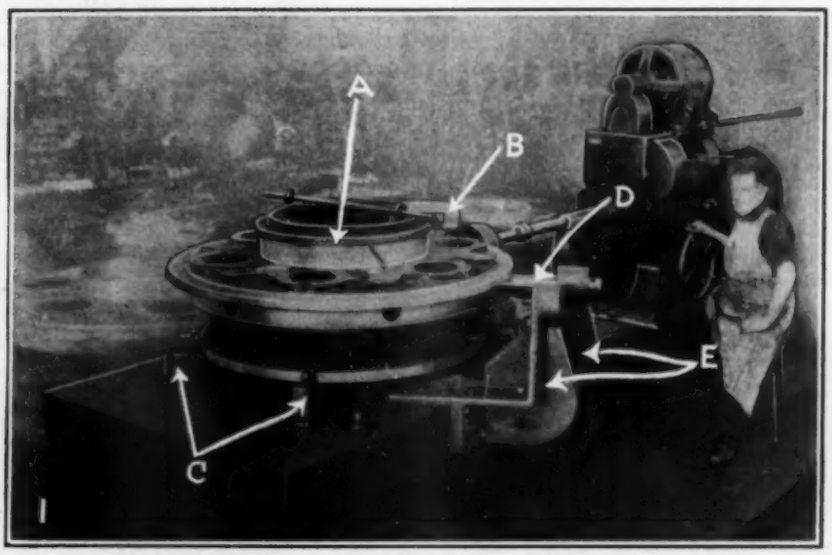


Fig. 1—Boring holes in the carrier for the lock-pins

Upon the next indexing movement of the carrier, by which movement this same spindle is removed to the second working station and a newly-loaded one brought to the first station, the tools of the second station take up their work at the point where those of the first station left off. As this transfer of spindles and partly finished work from one station to another recurs six times as the successive sets of tools carry on their allotted part in the orderly sequence of operations toward the completion of the piece, it is very evident to the observer that no ordinary duty of location devolves upon the indexing mechanism.

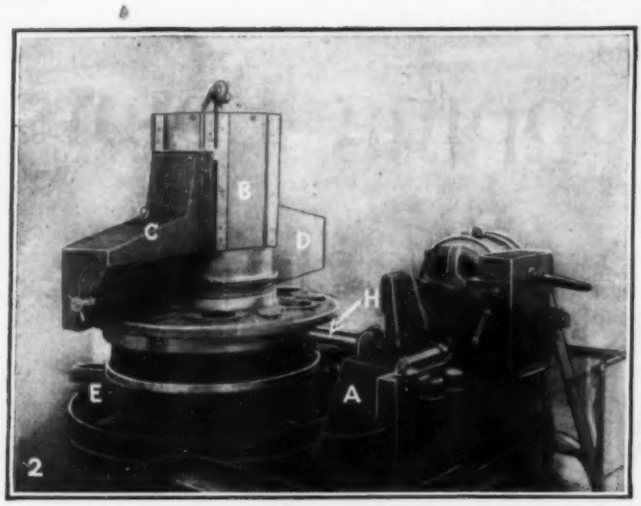
It is the purpose of this article to describe the tools and the methods employed by the builder of this machine to establish accurately the several positions of the carrier. When we consider that this member is nearly six feet in diameter and weighs, with the work-spindles and other attached parts, many hundreds of pounds, and, further, that each successive movement must locate the work and spindles well within a limit of 0.001 in., we realize the necessity for an extreme degree of refinement in this operation.

The carrier takes its main bearing upon the round, lower portion of the column, tapered toward the bottom, which is scraped to a bearing in the bore of the carrier. The weight of the carrier is partly borne by a ball thrust - bearing of large diameter, the upper race of which is secured in a seat machined into the under face of the carrier and the lower race held in position on the column by a ring-nut of equal diameter threaded to the lower end of the column.

The carrier is further supported in the finished machine by roller bearings located in the base of the machine and near the periphery of the carrier, but as these bearings do not enter into any of the operations that are described in this article, we will not consider them at this time.

The machining operations upon the carrier casting are performed upon Bullard Maxi-Mills, in which the

The first article. The second will appear in an early issue.



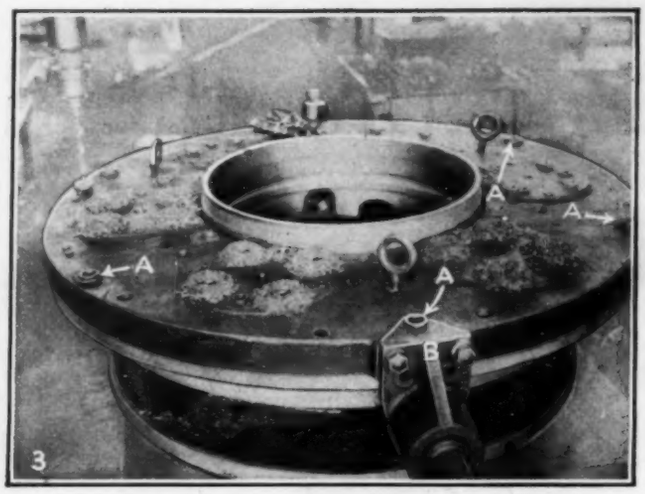


Fig. 2—Facing the carrier on its own bearings. Fig. 3—Jig-drilling the pilot holes

carrier is bored (afterward scraped to its bearing) turned and faced to finish dimensions, except that a few thousandths of an inch of metal are left upon the upper and under faces to be removed in a special operation that is a normal part of the sequence under consideration. From the boring mill the carrier is mounted as shown in Fig. 1 on a fixture in a modified horizontal boring machine to bore the six equidistantly-spaced and radially-disposed holes that are to receive the permanent male lock-pins of the indexing mechanism.

These holes, two of which may be seen in this illustration, are cored in the casting, a sufficient amount of stock being allowed to make sure that any error of spacing due to faulty setting of cores or arising from shrinkage of the casting can be corrected.

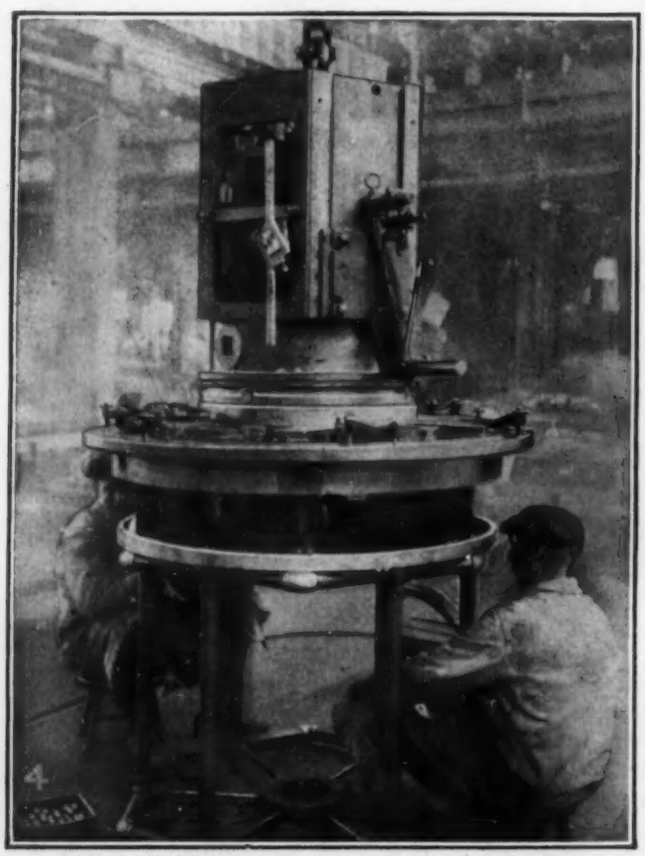


Fig. 4—Putting the column and carrier together

The fixture consists of a massive table of cast iron to which is permanently fastened in vertical position a hollow stud that is in effect a duplicate of that part of the "Mult-Au-Matic" column upon which the carrier is to take its bearing. This stud has at its foot the lower ring of a ball thrust-bearing that is identical with that in the finished machine. The height of the stud is such that it will project above the carrier far enough to receive a threaded ring by which the carrier can be confined against the thrust-bearing during the operation of boring.

Circles are first laid out on the periphery of the carrier to surround each of the six cored holes, being spaced as accurately as is possible to space them with a tram. This is to guard against a possible error in the casting by dividing such error, if it exists, and to assure that all of the holes will clean up, thus taking no chance of wasting time on a faulty casting. The operator then sets the carrier (it can easily be rotated by hand) to center one of the scribed circles with the spindle of the boring machine.

Three separate means are provided to secure the casting and insure that it will not move during the boring operation. First, the threaded ring *A* is tightened with a spanner and secured against becoming loose by the C-clamp *B*, which binds it to the wall of the hollow stud. Next, the straps *C*—of which there are four—are tightened to pinch the lower flange of the carrier between themselves and small jackscrews placed on the table of the fixture. Finally, two screw-tops of the kind commonly used to secure work on the table of a planer, are set into holes in the table of the fixture in position to bring their screws to bear upon opposite sides of one of the large holes in the lower flange of the carrier.

The tools applied in the boring operation are, successively, two core-drills (each hole is of two diameters); a boring bar carrying two cutters; a reamer and a tap. The hole is roughed out with the core-drills; rough-bored with the boring bar; the double-end cutters of the latter exchanged for finishing cutters and the hole finish-bored; then the smaller diameter is reamed to a driving fit for the permanent lock-pin, and the larger diameter at the outer end is tapped to receive a retaining plug. In the boring operation the pilot of the bar extends through the wall of the hollow stud and is supported inside the stud by a permanent bushing.

Having completed the first hole, the operator loosens all of the clamps, slacks off the ring nut at the top of

the stud, takes out the screw-tops and turns the carrier until the bar *D* enters the hole just bored. This bar slides in a bracket *E* that is permanently a part of the fixture and is so located thereon as to bring the center line of the bar to an angle of 60 deg. with that of the machine spindle.

Having thus indexed the carrier, the operator then clamps to the upper flange, in a position convenient for observation, a small angle-plate and brings to bear against it the button of a dial indicator that is fastened to a stationary part of the fixture, adjusting the dial of the indicator to read zero. This is an extra precaution taken to make sure that the carrier does not move while being clamped for the next boring, or during that operation.

The clamps are now tightened and the screw-stops set, the indicator showing the operator if any movement occurs. The pointer must remain at zero until all the work on the second hole has been completed. If it has shown no deflection at all, the operator may be satisfied that the second hole is spaced as accurately from the first as the fixture will space it. These operations are repeated for each hole bored, until all six have been finished.

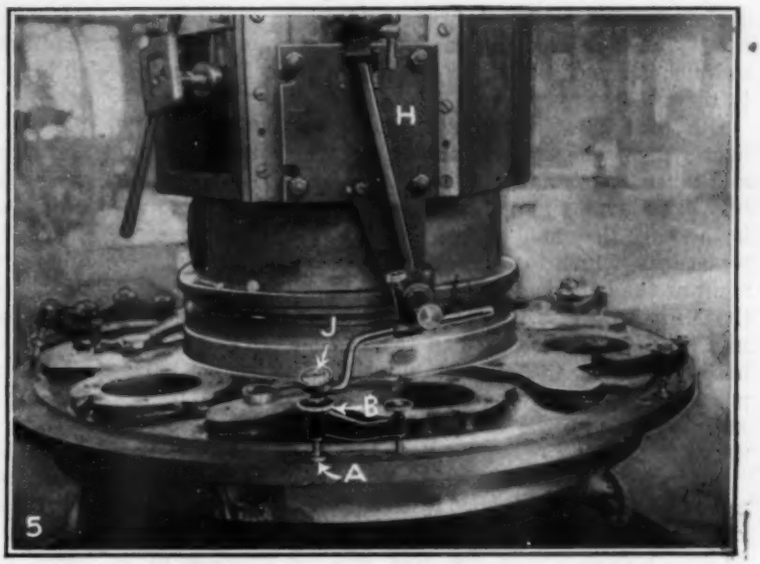


Fig. 5—Testing for concentricity

Special Rigging

The next step is to the machine shown in Fig. 2, which is the base, table and driving mechanism of a Bullard 61-in. Maxi-Mill with the housings replaced by the pedestal *A*, and with a platform to accommodate the driving motor. Before going to the machine, however, the carrier is assembled with its own column—the column that is to become a part of the same finished Mult-Au-Matic—including the identical bearings upon which it is to revolve in that machine. This column may be seen at *B* in this illustration.

To the column are attached two brackets, *C* and *D*, which have been machined to fit in the gibbed slideways upon its hexagonal face in which the toolslides of the finished machine are to travel. The underside of bracket *C* is further machined to receive a small toolcarriage that is gibbed to slide upon it in a direction radial to the column. The toolcarriage is fitted with a feed screw, on the outer end of which a starwheel is keyed to actuate the feed movement.

Bracket *D* is a duplicate of the casting from which *C* is made, but is machined only on the face where it fits the slideway. Its only function is that of a counterweight to balance the active bracket. Permanently mounted on the table of the Maxi-Mill is a secondary table *E*, which is the base of a Mult-Au-Matic with a slideway secured to it to accommodate a toolcarriage similar to the one shown on bracket *C*, and like that one it is fitted with a feed screw and starwheel.

The column with its attached brackets is, of course, the moving member. The carrier is held stationary by entering the bar *H*, sliding through bored bosses at the top of pedestal *A*, into any one of the holes just bored in the periphery. With the cutting tools properly adjusted, the machine is set in motion, and the toolcarriages on bracket *C* and on the base at *E* travel toward the column, facing the upper and under surfaces, respectively, of the carrier. The points of the starwheels contact at each revolution of the table with fixed stops on the face of the pedestal *A* to actuate the feed.

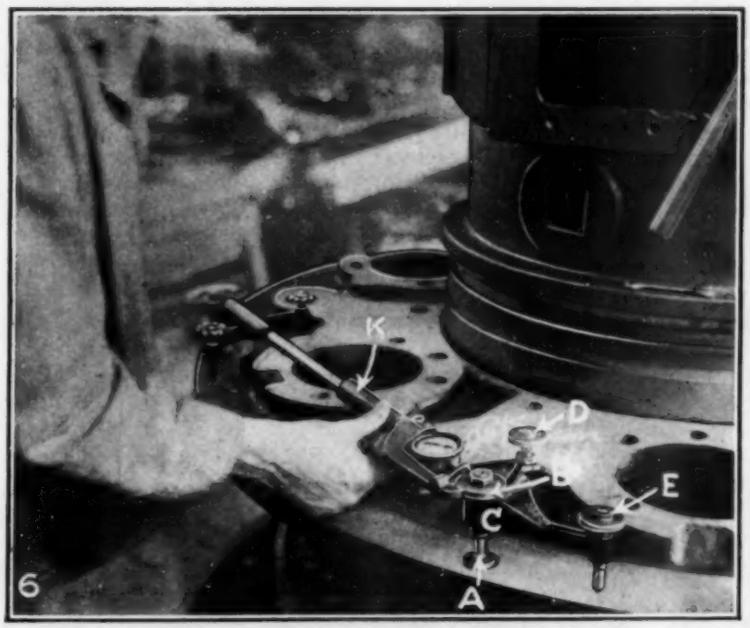


Fig. 6—Equalizing the chords of arcs

Marked for Assembly

The column and carrier are marked with corresponding numbers to make certain that these same members will come together again in the final assembly. They are now taken apart, the brackets are taken off the column and the carrier is sent to the next operation, where a number of holes are jig-drilled, most of which have to do with the attachment of the spindle bearings.

The jig shown in Fig. 3 locates many holes, and other jigs are used to locate holes in other parts of the carrier during this operation, but the only holes having to do with the sequence of operations we are now following, are those located by the small bushings *A* near the

periphery of the jig. A bracket *B*, which is a part of the jig, carries a locking bar to enter any one of the six radial holes just bored, to locate the jig with relation to them.

Our next point of observation is from the assembly floor, where the column and carrier are put together and taken apart many times in the course of an assembly. The large ringnut on the lower end of the column is the part that holds them together, and to remove or replace it—which involves, also, the removal or replacement of the balls and lower race of the thrust-bearing—the Mult-Au-Matic is deposited upon the frame shown in Fig. 4 to enable the men to get under it. The job here shown is the reassembling of these two parts preparatory to the operation of correcting the index. In Figs. 5 and 6 the same machine may be seen on the floor.

In each of the six pilot-holes near the periphery of the carrier—the holes that were located by the bushings *A* in Fig. 3—there is now set a gaging "button" that is designed especially for this job. It consists of a stud, to fit the pilot hole in the carrier, having a wide collar to bear above the flange, and a nut and washer to secure it from below; a hardened and ground disk, similar to a standard gage-disk, secured to the top of the stud; and a light cast yoke having two arms extending at right angles, with an adjusting screw parallel to the stud at the end of each arm.

The Gaging "Button"

The device may be seen to better advantage in Fig. 6, where *A* is the stud; *B* the disk, or "button," at the top of the stud; *C* the yoke; and *D* and *E* the adjusting screws at the ends of the arms. These screws are sharp-pointed, and when the device is approximately located they are struck lightly with a hammer to make prick-mark bearings for themselves in the surface of the carrier. Screw *D* is located on a radial line through the center of the hole in which the stud is secured, and screw *E* is at a corresponding distance to the right of the stud, circumferentially. The slender stem of the stud, being of tempered steel, is flexible. It is obvious that pressure applied by screw *D* would tend to spring the stem of the stud to carry the disk outward radially, while similar treatment with screw *E* would carry it tangentially to the left.

The part *H*, Fig. 5, is machined to fit one of the slideways of the column, and its function is to support the gaging devices used in the various stages of this operation. It is locked in the slideway by tightening the regular gib and remains stationary throughout the operation. At this stage it holds the dial gage *J*, the button of which bears against one of gaging disks *B* at the top of its stud.

It may readily be seen that by revolving the carrier to bring the several disks *B* into contact with the button of the indicator, successively, the relative radial positions of the disks will be shown on the dial. Setting the dial at zero on the first reading, the operator turns the carrier to bring up the other disks, one by one, setting each disk by a movement of screw *D*, Fig. 6, until they all read zero on the dial. The correction to be made rarely exceeds 0.001 in., for it will be remembered that these studs occupy holes already located by a jig that is as accurate as toolroom methods can make it.

This indicator and all the others used on this job, reads to half-thousandths, and the operator may turn the carrier around several times before he gets all the readings to suit him. When the radial settings have all been made alike, the operator applies the gage shown at *K* in Fig. 6 to equalize the chordal distance between the disks. At one end of this gage is a ring that has been accurately ground to fit the gaging disks *B*, while at the other is a dial indicator. A bent finger at this end rests upon the disk to steady the tool.

The operator sets the ring over one of the disks and applies the button of the indicator to the next adjacent disk, setting the dial to read zero. Shifting the ring of the gage to the next disk he tests the second chord, adjusting the position of the disk, if necessary, by turning the screw *E* to move the disk tangentially until the reading is zero.

Before making any corrections, however, he tests all of the chords in order to see where to start the correction, the idea being to divide the existing errors, if any, with the least possible amount of adjustment.

After the circumferential settings have been adjusted satisfactorily, the chordal gage is laid aside and the radial settings are again tested to see if the circumferential adjustments have disturbed them. These two tests are alternated, not once, but many times, until both radial and chordal gages read alike in all positions, indicating a condition of practically no error in the division of the circle.

But, the reader well may ask, what has all this to do with locating the positions of the carrier? We have established, very exactly, six positions where it *ought* to stop, and done nothing at all about stopping it there. This question will, however, be answered in a succeeding article, wherein the first picture will disclose the missing link.

Practical Railroad Ties Made from Scrap Rails

METAL railroad ties, constructed from worn rails by electric arc welding, are ten times as strong as wooden ties and can be made at low cost, according to William Dalton of the manufacturing department of General Electric Co., who has recently completed a test covering a year in collaboration with H. S. Clarke, engineer, maintenance of way, Delaware & Hudson Railroad.

Sample ties were tried about a year ago by the D. & H. in its Glenville yards and were so successful that it was decided to use them in yards and sidings and equipment will be installed in the shops for their construction.

The tie design involves the use of two pieces of rail for each tie. Two lengths are fastened together by metal plates welded in position. For fastening the track to the tie metal plates are welded to the tie and the track fastened to these with special clamping devices.

Analysis of costs by the D. & H. shows a total cost of $2.80 for a wooden tie. Cost of fabricating a metal tie is 60 cents and the scrap value of the tie is $2.50 making a total cost of $3.10. Inasmuch as the scrap value can still be realized after the tie is discarded, the net cost of the metal tie is 60 cents.

Present applications have been confined to yard and siding service. This field, however, requires over 30,000,000 ties a year for replacements.

In order to facilitate the easy and inexpensive manufacture of these ties a new type of automatic electric arc welding equipment has been designed.

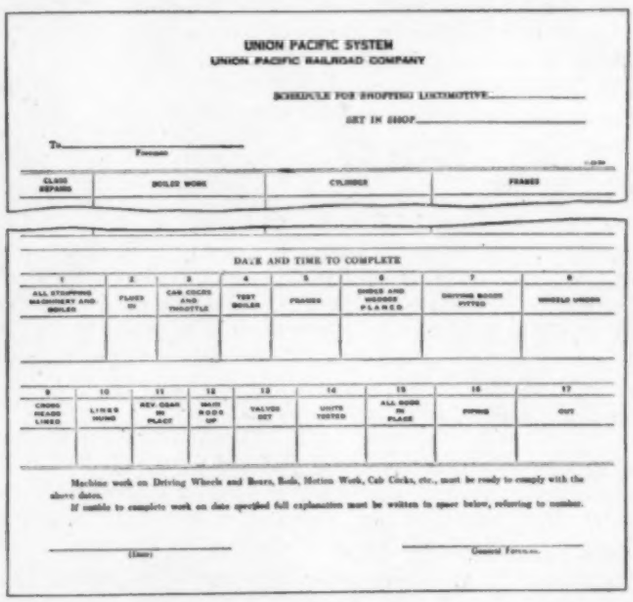
Miscellaneous

Handling Repairs on the U. P.

By Frank W. Curtis
Western Editor, American Machinist

Scheduling system for shopping locomotives — Holding weekly meetings for foremen to discuss repair work—Miscellaneous devices that assist in producing substantial repairs

LOCOMOTIVE repairs at the Union Pacific shops, Cheyenne, Wyo., are controlled by a scheduling system that records the class of repairs to be made and the estimated date that each unit repair should be completed. The system is not complicated, since the schedule sheet shown in Fig. 1 is the only form used. On the sheet is listed the engine number, the date it arrived for repairs, details of the work to be performed on the boiler, the cylinders and the frames, and the date the engine is to be completed. When an engine is received for repairs, the first step is to fill in the seventeen schedule dates listed on the sheets. These dates, specified by the general foreman, are estimated from time allowances based on the amount of work involved under each heading. Likewise, a cost allowance is automatically obtained from a master sheet that lists the class repairs, time allowances and estimated costs. To have a visual check of all the work being scheduled in the shop a small, master schedule board is maintained. The board lists the engines by number, and the estimated scheduled dates of the seventeen individual repairs as copied from the schedule sheets. As the work proceeds, the completed dates are recorded so that by observing the board at any time, it is possible to determine the condition of, and the progress being made on, each locomotive. The board is maintained by the general foreman, whose duty it is to see that repairs are handled according to schedule. Weekly meetings are held in connection with the scheduling system, by the shop superintendent and all foremen, to discuss any problems that arise. Any work that is behind the schedule is considered and recommendations are made that will aid in speeding up the work. The scheduling system, together with the meetings, has created a cooperative feeling among the shop forces, enabling the repair of locomotives to be handled more efficiently and at less cost than before the system was installed. Modern tools and labor-saving devices have been installed throughout the shop, some of which are illustrated. Bronze connecting-rod bushings are rolled to size


UNION PACIFIC SYSTEM
UNION PACIFIC RAILROAD COMPANY

SCHEDULE FOR SHOPPING LOCOMOTIVE_____

SET IN SHOP_____

To_____
Foreman

CLASS REPAIRS	BOILER WORK	CYLINDERS	FRAMES

DATE AND TIME TO COMPLETE

1	2	3	4	5	6	7	8
ALL STOPPING MACHINERY AND BOILER	FLUES IN	CAB COCKS AND THROTTLE	TEST BOILER	FRAMES	SHOES AND WEDGES PLANED	DRIVING BOXES FITTED	WHEELS UNDER

9	10	11	12	13	14	15	16	17
CROSS HEAD LINED	LINES HUNG	REV. GEAR IN PLACE	MAIN RODS UP	VALVES SET	UNITS TESTED	ALL RODS IN PLACE	PIPING	OUT

Machine work on Driving Wheels and Boxes, Rods, Motion Work, Cab Cocks, etc., must be ready to comply with the above dates.
If unable to complete work on date specified full explanation must be written in space below, referring to number.

_____ (Date) _____ General Foreman.

Fig. 1—Form used in scheduling locomotive repairs

The first article. The second will appear in an early issue.

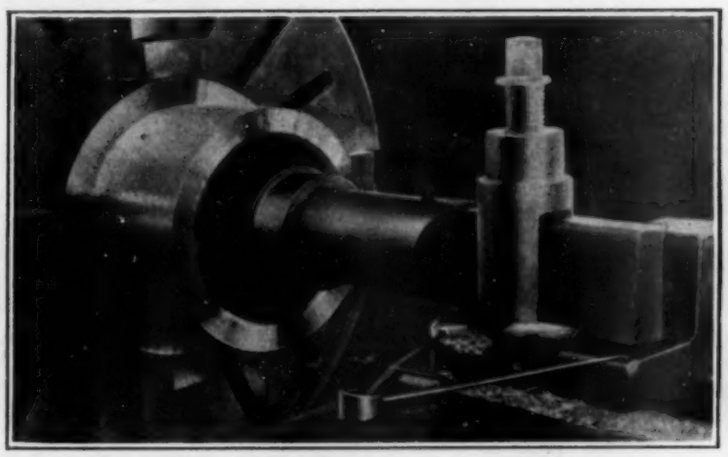


Fig. 2—Rolling a connecting-rod bushing.

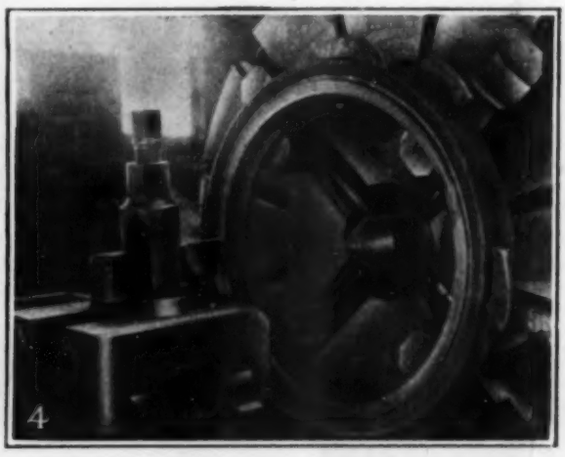


Fig. 4—Fixture for facing valve rings

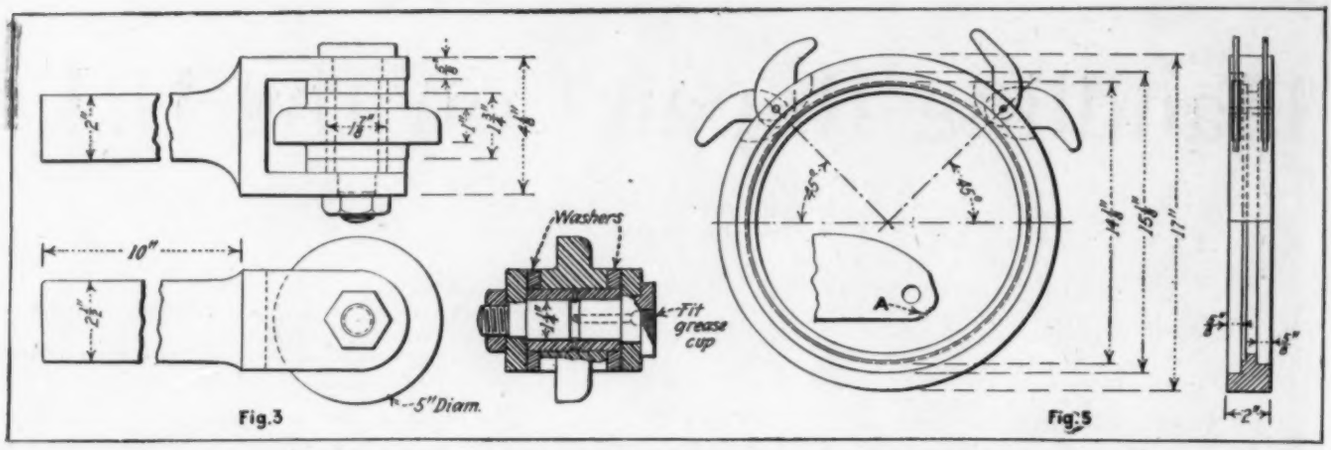


Fig. 3—Tool for rolling axle journals. *Fig. 5—Constructional details of fixture*

both inside and outside as shown in Fig. 2. The rolling tool consists of a bar flattened at one end to suit the toolpost. The opposite end of the bar has mounted on it a roller that runs on two roller bearings. The contacting surface of the roller is oval so that a smooth surface on the work is obtained. A small angle plate, fastened to the toolblock, carries a setscrew that prevents the bar from turning and slipping when in use. One pass of the roller completes a surface. Between 0.007 and 0.008 in. of metal is compressed. The work runs at 90 r.p.m. and the roller is fed 0.03 in. per revolution. Tests have shown that a bearing finished by rolling stands up longer in service than one finished by turning or boring.

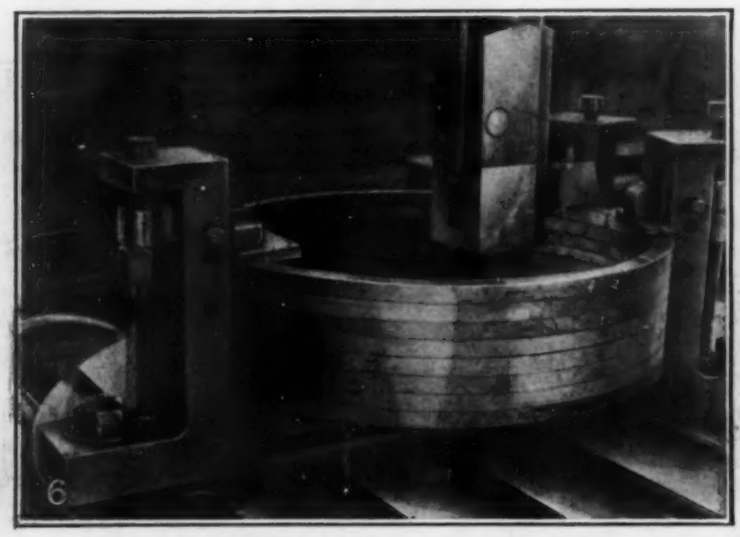
Axle journals also are rolled after being turned, and in Fig. 3 is shown constructional details of the rolling tool. One pass only of the roller is required, in which from 0.0025 to 0.003 in. of metal is compressed. The surface of the journal is run at a speed of 200 ft. per min. and the feed of the roller is $\frac{1}{16}$ in. per revolution. The roller, the pin, the bushing and the washers, are hardened and ground to insure smooth working of the tool.

Valve rings are faced in the fixture illustrated in Fig. 4. The fixture is held in a four-jawed chuck in a lathe, and by reversing it, two sizes of rings can be accommodated. In Fig. 5 are shown constructional details of the fixture. The ring is held by two dogs having serrated contacting faces as shown at *A*. Before the work is received for this operation, it has been turned and bored so that the fit in the fixture is held fairly close

Following the facing operation, the rings are split in a slotter as shown in Fig. 6. The fixture consists of three locating and clamping jaws attached to the table of the machine. Eight rings are split at once by a parting tool that is fed through them from the inside. Before the set-up is dismantled, the rings are chamfered at the outer edges of the cut.

For clamping work to be drilled, air-operated clamps such as the one shown in Fig. 7 are mounted on all radial and heavy-duty drill presses. The air cylinder is 26 in. in length and $6\frac{1}{4}$ in. in diameter. The stroke of the piston is 15 in. A helical spring within the cylinder forces the piston back when the air is released. Work of different thicknesses can be accommodated by changing the location of the fulcrum pin, for which purpose several holes have been provided.

If an article is too cheap, people are skeptical and afraid to buy it; if it is too expensive, they feel they are getting "trimmed." To charge the right price, one that will satisfy all, is a problem that must be solved to put business on a solid basis and assure the confidence of the consuming public.



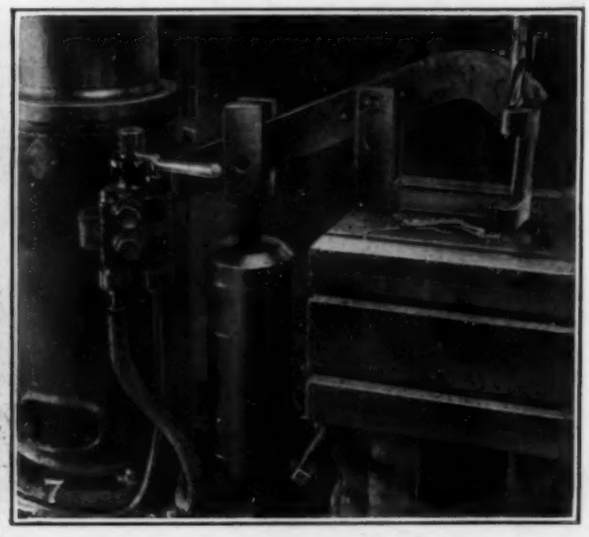


Fig. 6—Slotting eight valve rings at once. *Fig. 7—Air-operated clamp applied to radial drill*

Largest Group of Users of Metal-Working Machinery

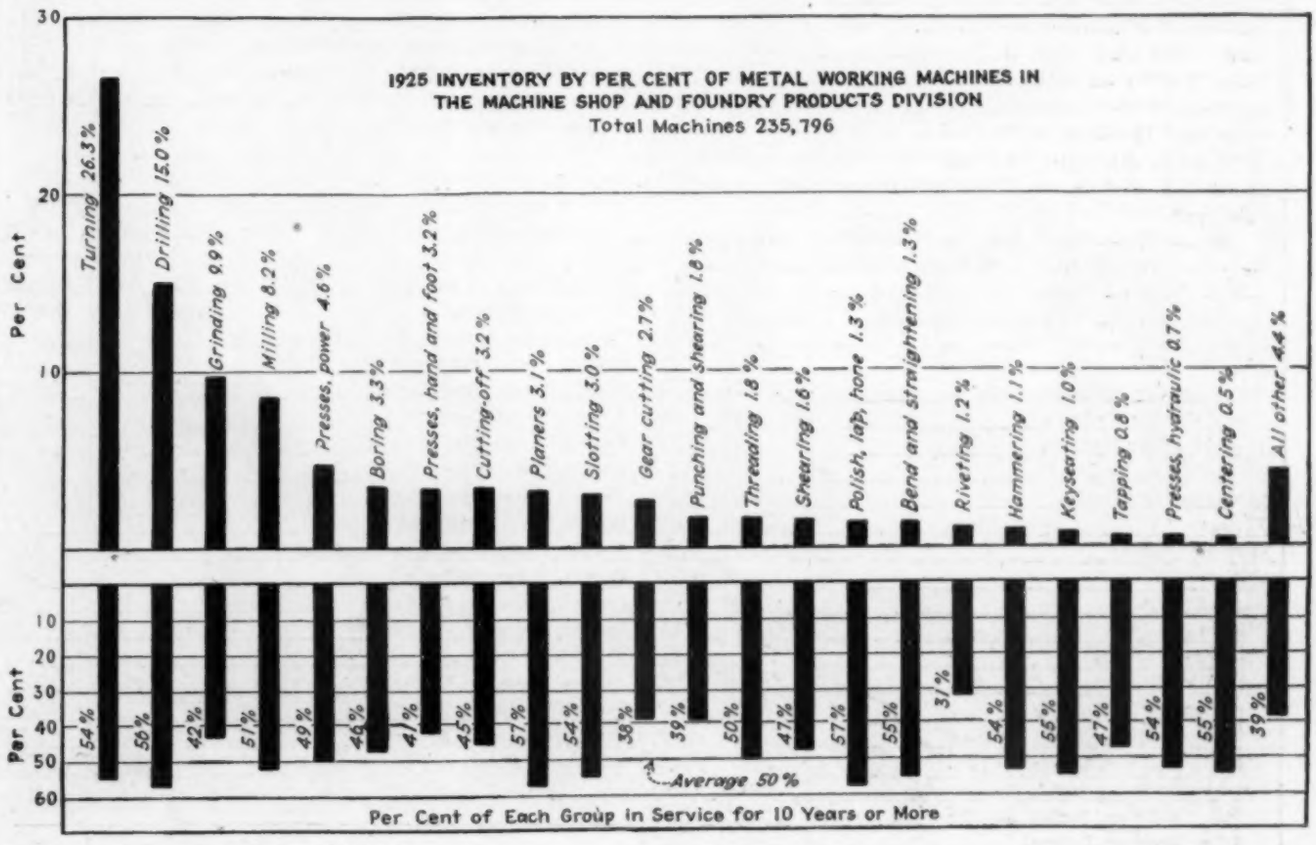
The manufacturers of machine shop and foundry products and equipment use many more metal-working machines than any other division in the metal-working field

MACHINE SHOP AND FOUNDRY PRODUCTS is the name by which this group is known in the U. S. Census of Manufactures. The group includes the builders of all types of mechanical equipment and machinery, exclusive of equipment for transportation and excepting certain machinery groups which have been studied separately. These exceptions include the manufacturers of agricultural implements, office equipment, metal-working machinery, pumps, scales and balances, sewing machines, textile machinery, washing machines, and electrical machinery, apparatus and supplies. The products of boiler shops and of foundries which operate alone are also excluded.

Counts of equipment have been made and published in the *American Machinist* in several of these above excepted specific groups. Several of these counts have been published. Others will be published.

The total count of the machine shops which operate alone and those with foundry departments brings this group to approximately 5,000 units, each employing 6 or more men and a total of approximately 334,000 workers. The total count of metal-working equipment comes to approximately 236,000 with 50 per cent at, or over, the 10-year service limit. Comparison of these counts with those of other groups in the metal-working field shows the group, as outlined, to be the largest of any by a considerable margin.

As in preceding studies on the metal-working equipment, published recently by the *American Machinist*, the distribution by operation per cent is given in the chart below. On the following page the questionnaire itself is reproduced and is filled in with the totals under each heading. From this tabulation it is possible to make counts of specific machines and also to estimate the needs for equipment and tools used in given connections.


1925 INVENTORY BY PER CENT OF METAL WORKING MACHINES IN THE MACHINE SHOP AND FOUNDRY PRODUCTS DIVISION
Total Machines 235,796
Per Cent
Turning 26.3%
Drilling 15.0%
Grinding 9.9%
Milling 8.2%
Presses, power 4.6%
Boring 3.3%
Presses, hand and foot 3.2%
Cutting-off 3.2%
Planers 3.1%
Slotting 3.0%
Gear cutting 2.7%
Punching and shearing 1.8%
Threading 1.8%
Shearing 1.6%
Polish, lap, hone 1.3%
Bend and straightening 1.3%
Riveting 1.2%
Hammering 1.1%
Keyseating 1.0%
Tapping 0.8%
Presses, hydraulic 0.7%
Centering 0.5%
All other 4.4%
54% 50% 42% 51% 49% 40% 41% 45% 57% 54% 38% 39% 50% 47% 57% 55% 31% 54% 55% 47% 54% 55% 39%
Average 50%
Per Cent of Each Group in Service for 10 Years or More

METAL WORKING MACHINES IN THE MACHINE SHOP AND FOUNDRY PRODUCTS DIVISION

Kind of Machine Tool	A Number Built Before 1915	B Total Number in Plants 1925	Kind of Machine Tool	A Number Built Before 1915	B Total Number in Plants 1925
Engine Lathes	18900	31400	Grinding Machines, Floor, No Feed Attachments	3421	7710
Hand Turret Lathes	1452	3285	Grinding Machines, Bench, No Feed Attachments	626	1215
Power Turret Lathes	3561	8524	Grinding Machines, Disk	744	1912
Semi-Automatic Lathes	212	815	Grinding Machines, Belt	342	779
Hand Screw Machines	2160	4040	Grinding Machines, Centerless	130	236
Automatic Screw Machines, Single Spindle	1463	2835	Polishing and Buffing Machines, Wheel	1628	2831
Automatic Screw Machines, Multiple Spindle	862	1971	Polishing and Buffing Machines, Belt	153	259
Chucking Lathes	591	1023	Polishing and Buffing Machines, Semi-Automatic	0	35
Multiple Spindle Chucking Machines, Rotary Work	24	24	Lapping Machines	12	25
Multiple Spindle Chucking Machines, Rotary Tools	35	118	Honing Machines	0	0
Speed Lathes	1771	2621	Cutting-Off Machines, Parting Tool Type	236	401
Bench Lathes	803	1995	Cutting-Off Machines, Power Hack Saw Type	2210	5092
Tool Room Lathes	1381	3114	Cutting-Off Machines, Rotary Cold Saw Type	626	1286
Wheel Lathes	118	129	Cutting-Off Machines, Band Saw Type	212	519
Axle Lathes	106	201	Cutting-Off Machines, Friction or Hot Saw	94	177
Forge Lathes	12	35	Shears, Knife	1180	2242
Hand Milling Machines	897	1900	Shears, Rotary	366	1005
Bench Milling Machines	212	283	Shears, Slitting	236	591
Plain (Knee and Column Type) Milling Machines	3780	7670	Nibbling Machines	106	331
Universal (Knee and Column Type) Mill. Mach.	1983	3979	Hammers, Steam	543	874
Vertical (Knee and Column Type) Mill. Mach.	1546	2728	Hammers, Pneumatic (not portable)	165	472
Lincoln Type Manufacturing Milling Machines	767	1321	Hammers, Drop	389	613
Semi-Automatic Type Milling Machines	106	567	Hammers, Helve	163	272
Continuous Mill. Mach. Rotary or Drum Type	24	106	Hammers, Spring	130	283
Planer Type Milling Machines	567	921	Riveting Machines, Pneumatic	354	1287
Gear Cutting Machines, Rotary or Milling Type	1475	2691	Riveting Machines, Hydraulic	12	47
Gear Cutting Machines, Hobbing Type	378	1652	Riveting Machines, Steam	0	0
Gear Cutting Machines, Planing or Shaping Type	579	2112	Riveting Machines, Power	508	1463
Vertical Boring Mills	2030	4549	Forging Machines, Hot, Bulldozers	224	461
Horizontal Boring Machines	1570	3351	Forging Machines, Hot, Forging Machines	94	224
Radial Drilling Machines	3650	8290	Forging Machines, Cold Headers, Bolt, Nut, etc.	24	48
Upright Drilling Machines, One Spindle	10490	15160	Forging Machines, Cold, Swaging	24	59
Upright Drilling Machines, Two or More Spindles	1865	4000	Bending Brakes	637	1157
Upright Drilling Machines, Two or More Heads	319	531	Bending Rolls, Horizontal	850	1665
Sensitive Drilling Machines, One Spindle	2315	5195	Bending Rolls, Vertical	36	59
Sensitive Drilling Machines, Two or More Spindles	885	1960	Straightening Rolls	201	248
Sensitive Drilling Machines, Two or More Heads	47	106	Punching Machines	1085	2400
Two-, Three- and Four-way Drilling Machines	153	224	Combined Punches and Shears	543	1782
Tapping Machines, Single	532	1345	Presses, Hand, Arbor	2346	6990
Tapping Machines, Multiple	319	448	Presses, Hand, Light Punch Press Work	153	389
Pipe Threading and Cutting Machines	933	1700	Presses, Foot, Light Punch Press Work	601	1145
Bolt Threading and Cutting Machines	685	1429	Presses, Power, Crank Type	4520	9150
Thread Chasing Machines	106	307	Presses, Power, Toggle Type	236	448
Thread Hobbing Machines	59	71	Presses, Power, Double-Acting Type	36	153
Thread Milling Machines	71	437	Presses, Power, Dieing Type	94	153
Thread Rolling Machines	212	224	Presses, Power Automatic	71	153
Planers	3790	6600	Presses, Power, Trimming Presses	36	71
Open-side Planers	342	637	Presses, Power, Forcing, Arbor, Wheel	130	283
Shapers	3045	5751	Presses, Power, Baling	24	48
Vertical Shapers	94	236	Presses, Hydraulic, Bending, Forming, Drawing	260	378
Slotters	626	1005	Presses, Hydraulic, Forging	12	24
Broaching Machines	272	802	Presses, Hydraulic, Flanging	48	94
Keyseating Machines	1275	2326	Presses, Hydraulic, Forcing, Wheel, etc.	508	1027
Centering Machines	602	1096	Presses, Hydraulic, Baling	12	36
Grinding Machines, Plain Cylindrical	1216	2539	Presses, Hydraulic, Extruding	24	24
Grinding Machines, Universal Cylindrical	697	1748	All other machines and miscellaneous	3412	8720
Grinding Machines, Surface, Reciprocating	862	1948			
Grinding Machines, Surface Rotating	342	838			
Grinding Machines, Internal	390	981			
Grinding Machines, Cylinder	177	437			
Grinding Machines, Cutter	1096	3059		117648	235796

Automotive Production

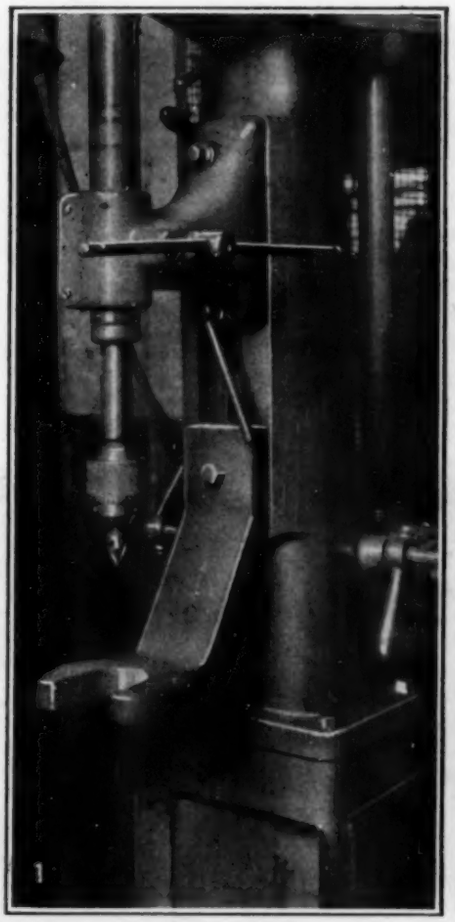
Franklin Crankshaft Operations

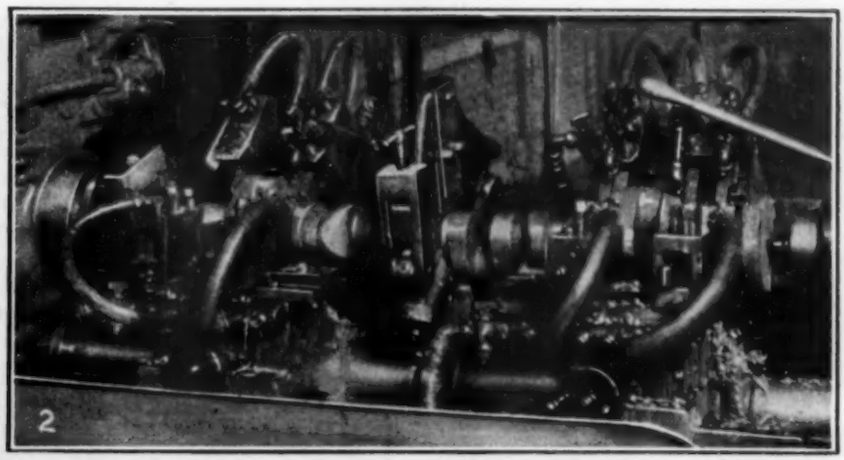
By FRED H. COLVIN
Editor, American Machinist

Franklin is one of two builders of engines using carburized and case hardened crankshafts—The machining and balancing operations are shown

CRANKSHAFT forgings are sand blasted and are then centered, in the upright drilling machine shown in Fig. 1. The forked arm attached to the column acts as a guide for the upper end of the shaft. The center bearing is spotted, or rough turned, for the steadyrest and then the shaft goes to the Fay lathe, Fig. 2, where four more of the seven bearings are rough turned and the cheeks are faced. These bearings are rough ground as guides for future operations.

Crankpins Nos. 3 and 4, are being turned on the Wickes crankshaft lathe shown in Fig. 3. The shaft is well supported by four clamps in the two throw blocks. A good





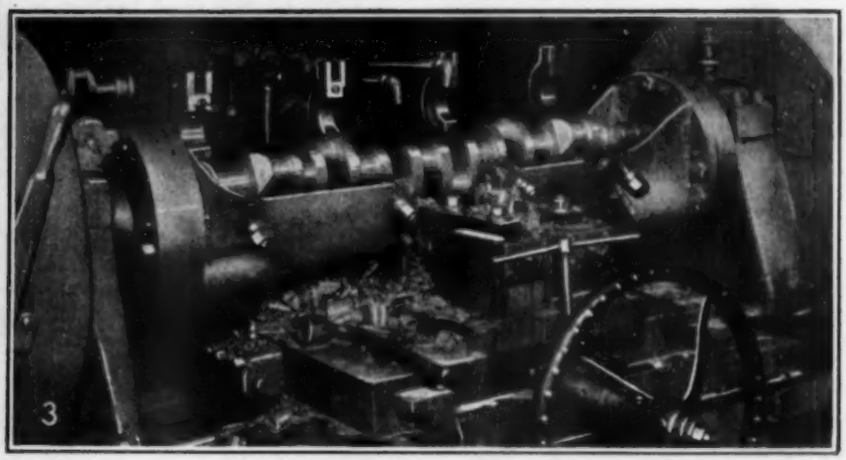
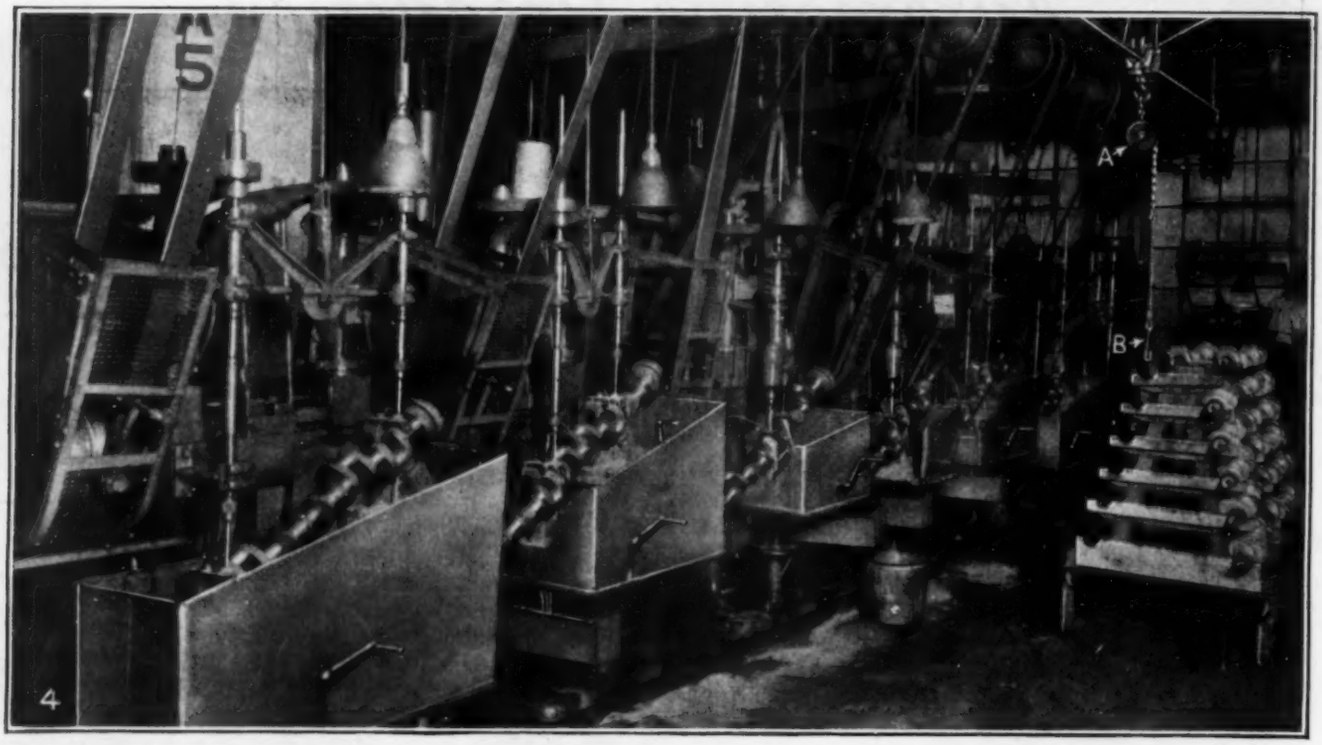


Fig. 1—Where crankshafts are centered. Fig. 2—Rough turning main bearings. Fig. 3—Turning crankpins in lathe

Automotive Production



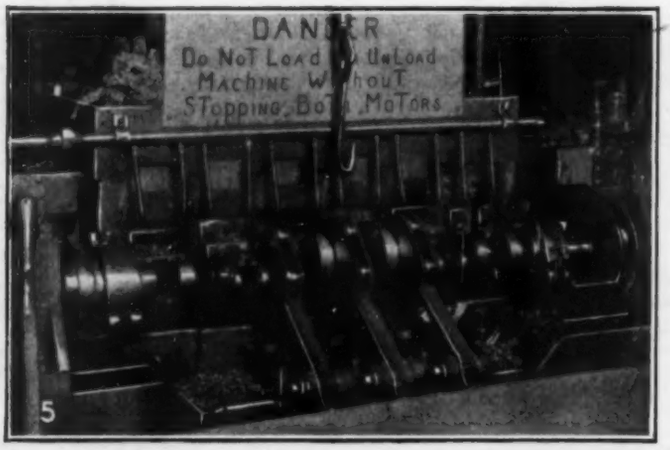
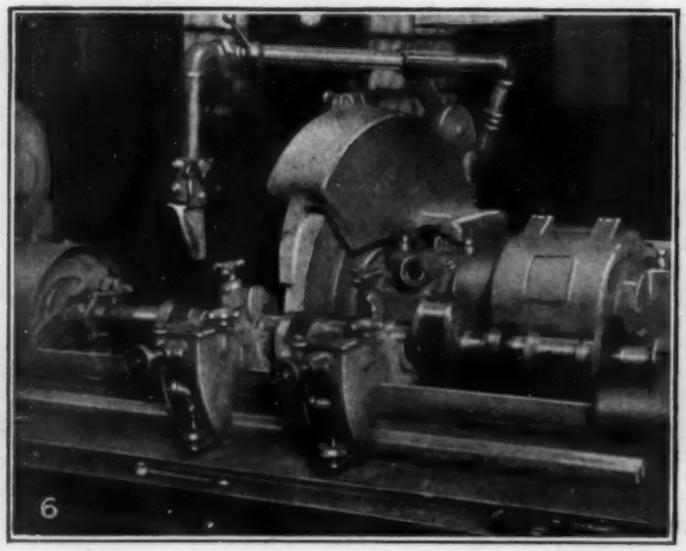
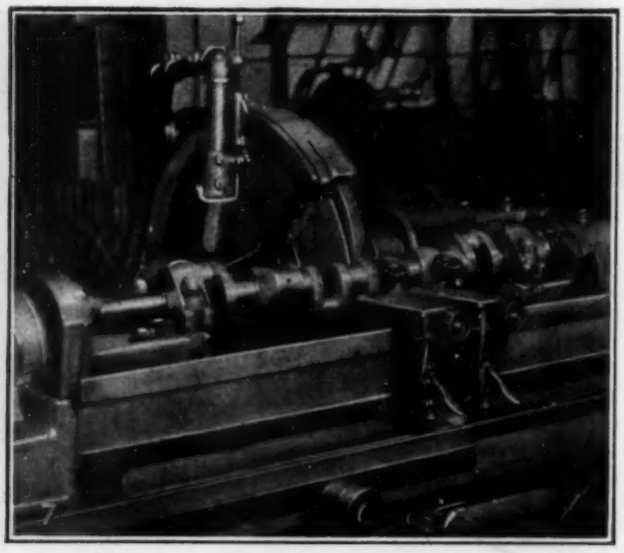


Fig. 4—This battery of machines is drilling the oil passages to the various bearings. Fig. 5—The contours of all twelve crankthrows are turned at one operation. Fig. 6 — The first finish-grinding operation is done on the main bearings. Fig. 7 — For grinding the crankpins, special attachments, or "throw blocks," are necessary to bring the various pins into line





Automotive Production

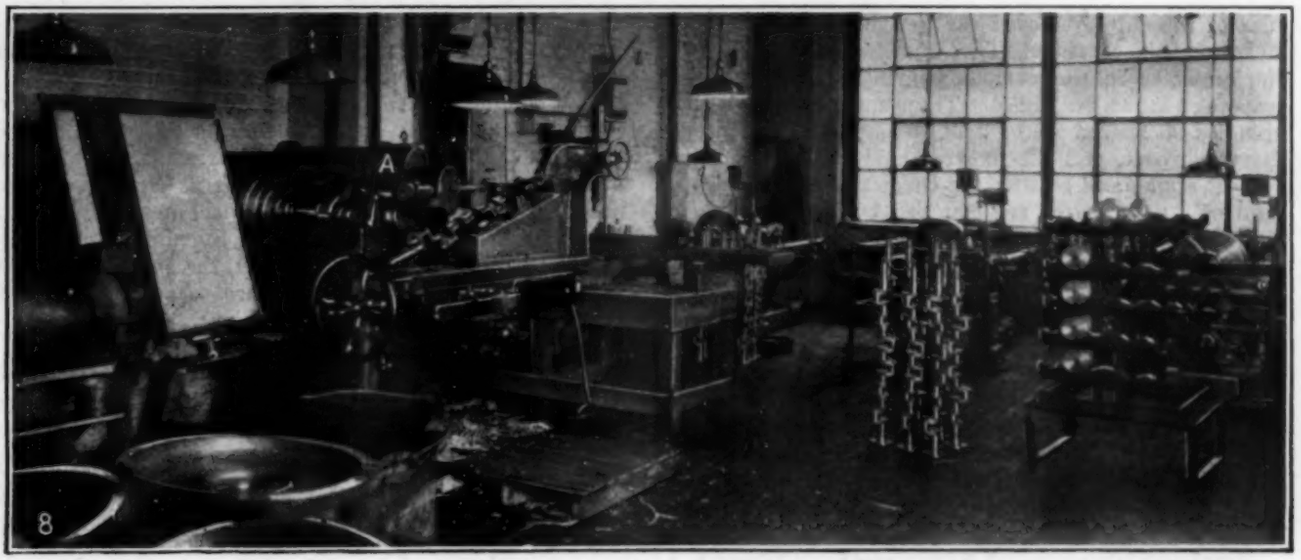
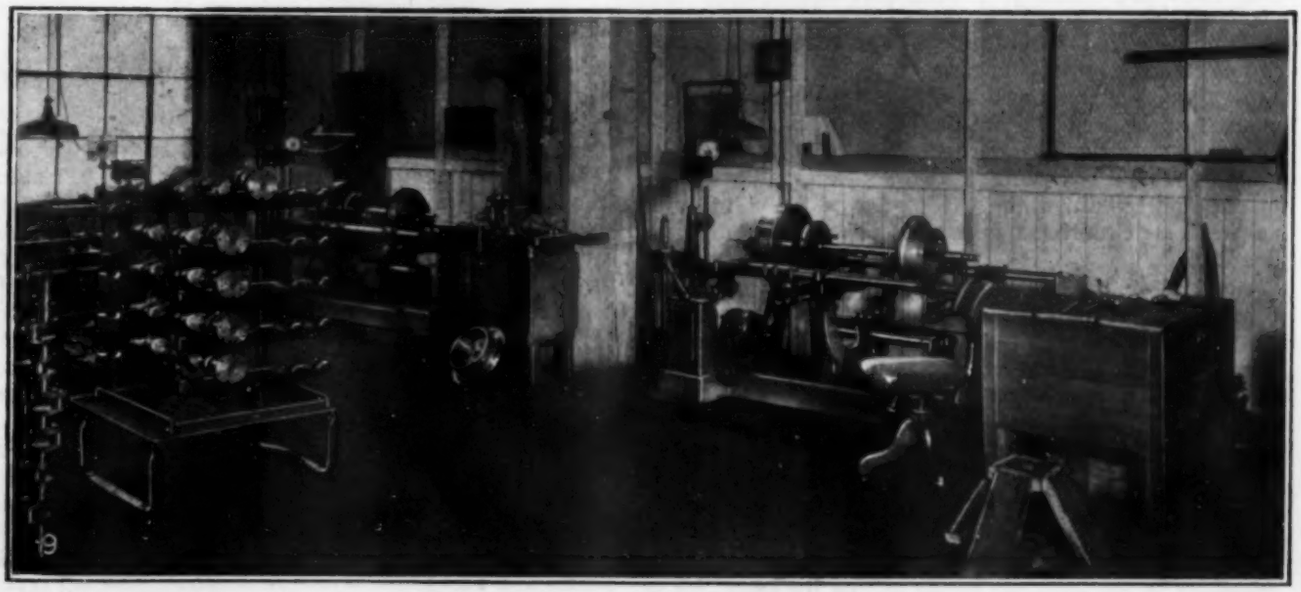


Fig. 8—Balancing crankshafts is a delicate operation, and is done in a separate department specially fitted up for the work. The surplus metal is removed from the heavy sides by milling. Fig. 9—Another corner of the balancing department. Here the flywheels are balanced. The movable racks for holding and transporting the crankshafts can be seen at the right. Fig. 10—After all machining operations have been completed, the crankshafts are washed in the tanks to be seen in this picture



Automotive Production

idea of the chips removed can be had from the ones to be seen on the carriage. Then the cranks are drilled for the oil holes in the various bearings in the gang of machines shown in Fig. 4. These machines have their spindles so spaced as to drill the holes at the proper distance apart, and the fixtures hold the shafts at the correct angle, and so that the throws are in the proper position. The shafts are clamped by the levers to be seen outside of the guard, and ample lubrication is provided. The rack at the right shows how the shafts are stored, ready to be carried to the next department.

A light monorail is provided for handling the crankshafts into and out of the machines. Instead of a hoist, a special snubbing device is supended from the trolley hook as at *A*. The hook *B* is pulled down to take the shaft in the center, and the recoil of the spring in the snubber helps to lift it into the fixture. This device is more rapid than a hoist and involves very little mechanism. After drilling, the oil holes are plugged and the shafts are carbonized.

The contours of the crank throws are turned on the Melling lathe in Fig. 5, which finishes all twelve at one operation. In Figs. 6 and 7 line bearings and crankpins are being ground on Norton machines. Crankshafts are balanced on Precision balancing machines in a special department, as shown in Fig. 8. Surplus metal is removed by the milling machine at *A*, the shaft being held in the proper position by the fixture. Another corner of the balancing room is shown in Fig. 9 where the flywheels are balanced. This view shows the rack for holding and carrying the crankshaft between departments.

After balancing and before going to final assembly, the oil holes are flushed, and the whole shaft is thoroughly cleaned. Fig. 10 shows the cleaning tank.

What the Ford Schools Are Doing

FEW realize the extent of the good work that is being done in the two Ford schools in Detroit. Beginning in October, 1916, with six boys and one instructor, the Henry Ford Trade School has grown to 1,600 boys and 125 instructors. Only boys of from twelve to fifteen years of age are admitted, and needy boys from Detroit have preference, fully 80 per cent being compelled to help support themselves. Each boy receives $7.20 a week from the start, this being increased if he progresses satisfactorily, to $18 a week for a seventeen-year old boy in his third year. In addition he receives $2 per week that must be deposited in some bank and kept there as long as he remains in the school, bank books being examined monthly. A hot lunch is also furnished to all. Classes are from 7:30 a.m. to 3:55 p.m., five days a week. Supervised athletics are encouraged.

The school shop is separate from the Ford plant and covers three acres, the series of rooms totaling 1,400 ft. in length and having an average width of 70 ft. The total equipment is valued at over $1,000,000. There are eighteen departments, and two men spend their time shifting boys who have attained the required proficiency in one department, to the next. Each job is done on a work order and no work is done for practice. Every good piece is used and credited to the school, the average boy producing approximately $1,000 worth of usable material per year. This pays everything except interest on buildings and equipment. Five points are emphasized: cleanliness, safety, accuracy, speed and ingenuity.

At eighteen, the boy enters the senior course, working 8 hr. a day in the shop and having 4 hr. per week of advanced drawing and mathematics. His rate gradually increases to $30 per week at nineteen, and may reach $40 at twenty, when he is offered a position in the Ford Motor Co. Graduates are now holding important positions there and elsewhere.

The Ford School of Technology conducts all of the educational work of the Ford Motor Co. in the developing of trained men. Several hundred young men from twenty to twenty-five years of age, work as apprentices in the toolroom beside skilled workmen, for a three-year course. A special foreman in each toolroom moves them from machine to machine as they progress. These men start at the Ford minimum wage of $6 per day, increasing to $8 at the end of the course. There are nearly 2,000 apprentices in the Highland Park and Fordson plants. There are also courses in electricity, metallurgy and metallography.

Another department is known as the Ford Service School, which is a sort of special apprenticeship to fit young men for Ford and similar service in various countries. This school has over 300 students from more than 30 different countries, such as Australia, China, Egypt, India, Japan, Persia and Turkey. Most of these young men desire to carry back to their countries, ideas and training that will be of national service.

The Ford Motor Co. also employs about 200 co-operative students from various institutions, many of whom remain with the company after finishing their courses. All these activities include 4,000 individuals, a teaching force of 160 men and an expenditure of $7,000,000 yearly.

American Cars, Replacement Parts, and Accessories in Australia

ACCORDING to figures of the United States Department of Commerce, there were about 374,717 automobiles in circulation throughout Australia as of Jan. 1, 1927. Regardless of age or nationality of these cars, the United States automobile replacement-parts exports to Australia amounted to over $7.73 per car, and this per-car value would increase to almost $10 if Canadian replacement-parts exports were added. During 1926 the United States exports of automobile accessories and service appliances to Australia averaged about $3.71 per car.

The percentages of cars of American make, in operation in various parts of Australia last year, were as follows: New South Wales, passenger cars, 79; trucks, 78; buses, 68. Victoria, passenger cars, 72; trucks, 82; buses, 60. South Australia, passenger cars, 78; trucks, 86; buses, 94. Queensland, passenger cars, 79; trucks and buses, 89. Western Australia, 80, all types.

Heat-Treating
at Brown & Sharpe's

By ELLSWORTH SHELDON
New England Editor, American Machinist

Electric furnaces are employed to harden cutters—Selective hardening—Various types of furnaces for other work—The tempering is done as a separate operation

IN THAT division of the heat-treating department of the Brown & Sharpe Manufacturing Co. where carbon steels are handled, a battery of electric furnaces is employed to heat milling cutters for hardening. These furnaces are not, however, provided with automatic control, since they are not required to carry sustained heats, but each one is equipped with an automatic recording instrument that serves not only to guide the operator but to make a permanent record of each operation. Fig. 9 shows one of the furnaces from which the operator is preparing to withdraw a charge.

The cutters are placed loosely upon a pedestal of refractory material at the bottom of the heating chamber and the temperature is allowed to rise slowly to the critical point as indicated by the pyrometer, when they are taken out with tongs and quenched in oil or water according to the nature of the steel. Hardening temperatures range from 1,400 to 1,500 deg. F., varying with different steels. Many small parts are heated for hardening in molten lead. The lead pots are permanently set in coal- or oil-fired furnaces, where they are covered by hoods connected to the exhaust system to carry away the fumes from the lead and the gases from the fire. Parts of machinery steel that have been carbonized in the large furnaces are later heated for hardening in the lead pots, being handled as though they were of tool steel. A layer of crushed charcoal is placed on the surface of the molten lead to prevent undue oxidation.

Fig. 9—Heating cutters in the electric furnaces

In one battery of muffle furnaces, used to heat larger parts, the thermocouple of each furnace is connected to an indicating pyrometer on a panel at the side of the room. The operator responsible for the output of the battery is stationed at the panel, from whence he directs the activities of a corps of assistants. When the pyrometer connected to any furnace shows that the correct temperature has been reached, the operator flashes a white light at that furnace, indicating to the assistant that the charge is to be withdrawn and the furnace reloaded. These furnaces were installed primarily to harden automobile gears of alloy steel, but are now used for a variety of work.

There are many parts to be pack-hardened or carbonized, and this work is done in the coal- and coke-fired furnaces. The parts are packed in cast-iron boxes, or pots, with the carbonizing material. To protect the contents of the boxes from the direct heat of the fire, the carbonizing material is in many cases left about half an inch below the edge of the box, and the remaining space is filled with cast-iron chips.

Sometimes these chips are the only covering employed. At others, when a deep case is required, a cover of sheet metal is luted in with clay in the usual manner and a layer of chips is spread over it. During the progress of the heat, the chips fuse into a cake that can easily be lifted off intact with a fire iron when the boxes are withdrawn from the furnace. Besides protecting the contents of the boxes, this scheme offers a ready means of disposing of an otherwise waste product. Many parts are handled that need to be hardened upon a portion of the surface only, leaving the remainder of the metal in its original state. To accomplish this result, fire-clay is molded around the part, leaving exposed only that part of the surface that it is desired to harden. The parts thus protected are packed in the regular manner and are heated for the required length of time, when the boxes are withdrawn from the furnace and allowed to cool before being opened. The individual parts can then be hardened by heating in lead and then quenching, or by any suitable method. That portion left unprotected by the clay only is susceptible to hardening.

The second and concluding article.

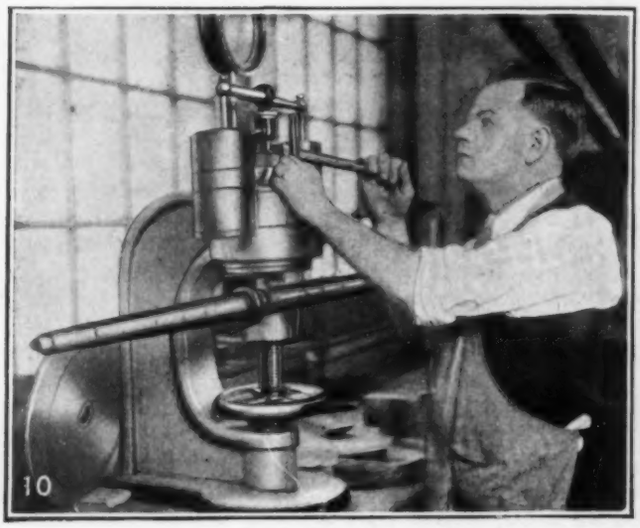
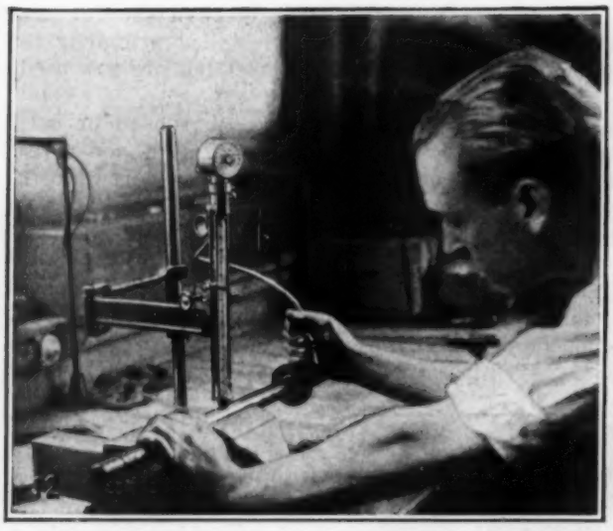


Fig. 10—Applying the Brinell test. Fig. 11—Testing hardness of high-speed steel cutters with the Rockwell instrument



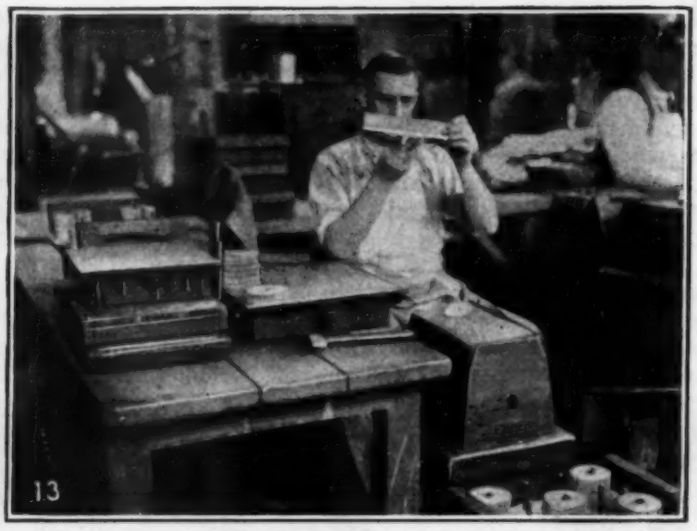


Fig. 12—The Scleroscope as applied to many parts. Fig. 13—Straightening saws by the hammer method

All hardened work passes through the hands of the inspectors before it is checked out. Brinell, Rockwell and Shore instruments, the hammer and file, are all used to test the degree of hardness, each instrument or tool having its peculiar advantage for the range of work upon which it is used. Figs. 10, 11 and 12 show, respectively, the application of Brinell, Rockwell and Scleroscope tests to different pieces of work, and the methods of using these instruments, which have become essential to the modern hardening room, are clearly indicated.

The kind of steel, character of the piece, and method of heat-treating, all serve to determine how best to test the resulting hardness. Tests are frequently made with more than one instrument because of certain characteristics of a piece that causes it to display false hardness values, notwithstanding the readings taken from the instruments. As a further safeguard, all classes of work are tested with a file, whether or not the instruments are applied. The file used is not an ordinary tool, of its kind, but one that is made specially for the purpose and is held rigidly to certain fixed standards.

Many hardened parts are so frail that they cannot safely be subjected to the pressure of the Brinell or Rockwell instruments, or even the light blow of the Scleroscope, and the standard file is relied upon to show results. A percentage of each lot of parts is tested, and if rejects are found among this percentage the entire lot will be tested.

An important part of the inspection equipment is the projecting lantern, which is used to check—both before and after the hardening operation—cutters and tools, the forms of which must be maintained within very close limits. This installation is located in another department, but is used extensively in connection with difficult hardening problems.

A large airy darkroom is equipped with two projecting lanterns, one for large and the other for small work. The gage, tool or cutter to be tested is mounted in the projector and the beam of light carries the image to a mirror from whence it is reflected to a screen of ground glass located conveniently for observation by the operator. An inspector is on duty at all times and is kept busy checking all classes of work that must be held close to form.

On some of the work inspected by this method, the part is magnified 200 diameters, at which enlargement

a human hair appears to be as large as one's thumb. For most work, however, a magnification of 62½ diameters is employed. This may seem an odd figure, but it is really quite a logical one, as each 0.001 in. upon the work appears as ¹⁄₁₆ in. on the screen.

A piece of work while still soft, the form tool with which it is made, or the gage it must fit after hardening, are projected and penciled on the screen of ground glass. Then each piece of work is projected after hardening and the shadow is matched with the penciled outline. With the magnification above mentioned it is easy to see and measure any distortion or burning off of the contour.

The hammer test is applied to casehardened parts, and is very reliable. Some of the inspectors who have been on the job for many years can judge very accurately the depth and condition of the case by the feel of the hammer blow. The sound test is applied for cracks wherever possible, and, as a matter of course, all parts are scrutinized carefully for visible defects.

Thin saws, blades of squares, straight-edges and many similar parts that are subject to warping and are to be finished all over by grinding, are straightened by hammering them on a smooth-faced anvil, testing them for flatness with surface plates and straight-edges. Fig. 13 shows the operation.

Arbors, mandrels, machine spindles, end mills, reamers and a variety of parts of this nature are straightened by means of screw-presses and are tested on centers. For this class of work the screw-press is provided with a long planed bed, or table, on which may be placed a pair of centers, or V-blocks, or both, as the nature of the work may require. A slot extending over the length of the table aligns the centers or V-blocks by engaging a tongue on the base of each fixture.

The press is placed in a shallow pan of sheet metal, from which a waste pipe carries away the water that is used freely upon some work. Beside each press is a smooth iron table on which centers or V-blocks may be placed to test the work away from the press when it is more convenient to do so.

Each operator is provided with a gas torch, supplied with city gas through flexible tubes, also a rubber hose to deliver water upon the work whenever it is necessary. A piece to be straightened is placed on the centers, rotated by hand, and the high spots marked. It is then transferred to the V-blocks and light pressure is brought to bear upon it with the screw.

Heat is then applied by means of the torch, and the pressure of the screw is increased to effect the straightening. The heat is confined to the desired area by flowing cold water from the hose over the work each side of where the bend is to be made.

Fig. 14—Straightening round work under a screw-press

Fig. 15—The tempering room

The operator must be very careful in applying the heat, not to get the piece hot enough to draw the temper. The straightened parts are tested by means of a dial indicator mounted upon the adjustable bar of a surface gage. Fig. 14 shows the equipment and the manner of using it.

The space shown by Fig. 15 is occupied by the furnaces and other appliances used to temper carbon steel and casehardened parts. The equipment comprises both gas-fired and electric furnaces; a rotary gas furnace for tempering and bluing springs; oil baths, heated by oil fires and by electricity; and vats for water and potash solutions, heated by steam.

Tallow is the material used exclusively in the oil tempering baths, since it will safely stand temperatures up to 575 deg. For work that requires a higher temperature, the electric furnace is used. A large variety of work is tempered in the molten tallow, since that medium lends itself admirably to the tempering of many small parts, the heat being distributed uniformly and controlled with accuracy.

Small parts to be tempered in the oil are placed in wire baskets suspended from rods laid across the open top of the tank. Slitting saws are not only tempered but are straightened at the same time. They are strung upon long bolts fitted with wire collars and are put under pressure by drawing up the nuts of the bolts. This treatment causes any of the saws that are warped to flatten out, and after they have been in the hot oil long enough to draw the temper, they will remain comparatively flat after the pressure is released. Parts tempered in oil are washed in hot potash solution, rinsed in clear water and dried in sawdust.

The rotary furnace to be seen in Fig. 15 offers a very convenient means for tempering springs, since the temperature is easily controlled and all parts are subjected to the same heat as they are rolled about in the slowly revolving chamber.

Notwithstanding all of the modern furnace equipment, electric and other sensitive indicating and recording instruments, and the versatile instruments for testing the hardness of parts as they come from the various operations, the day of the skilled workman has not passed, although the skill of today is largely based upon the more scientific study made possible by these perfected instruments.

THE · FOREMAN'S · ROUND · TABLE

Paying the All-Around Man

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"SAW you having quite a confab with the Big Boss, Al. What's the idea? Hitting him for a raise?"

"Yes, Ed, but not for myself—for Charlie Miller."

"And why Charlie Miller? He isn't such a great producer, is he?"

"Yes, Ed, he is. But it doesn't show as much as it ought to."

"Don't get you at all, Al. Charlie's a nice chap and a good worker. He knows machines too, and can usually put his finger on the trouble when one goes on the bum. But he isn't a producer—don't see why Williams should boost him any."

"That's the way Williams talked at first. But I made him see that Charlie is a real producer, only it's a bit indirect."

"Riddles again, Al. Spill it!"

"You admit that Charlie knows machines—that he knows what ails 'em when they fall down on the job. You also know that Charlie Miller can fix 'em up and have 'em running in less time than any man we've ever had."

"Well, isn't that what he gets paid for, Al?"

"Sure, but he doesn't get paid enough. This firm hires a lawyer and pays him a retaining fee just because he knows how to get 'em out of a law scrape. When they have a law case he gets a wad of money besides."

"Well, where does Charlie come in? Are his services professional?"

"Why, don't you see Ed, we pay Charlie a retaining fee for his knowledge, but we don't hand him anything extra when he gets us out of a jam. With all his knowledge and ability he doesn't get any more money than the best piece workers on the machines he fixes."

"I showed the Big Boss that what we'd lose in production if it wasn't for Charlie was a lot more than a little boost that would make him happy."

"And he fell for it, Al?"

"He sure did, Ed."

"Guess you ought to have been a lawyer instead of wasting time in a shop, Al!"

How much is it worth to keep machines running?

Does the reliable all-around man get enough as compared with the piece worker?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

How Do Mutual Aid Societies Help?

AL'S plan has been in effect in the Hess-Bright plant for the past 14 years. We have a benefit society that pays its sick members $8.00 a week, payments not to exceed 13 weeks in any one year. In the event of a member's death, his beneficiary is paid $100. A sinking fund, aided by a generous yearly contribution from the company, is held in reserve to meet any emergency. Employees wishing to join the society pay an initiation fee of 50 cents, and 50 cents each month as dues. The company furnishes space, rent free, for a candy and tobacco stand, which is operated for the benefit of the society. This stand, which is open only at the lunch hour, is a big factor in the accumulation of funds for the annual distribution. At the end of the year, all money in the treasury, excluding the sinking fund, is divided among the members. The beneficial disbands, and a new organization headed by newly-elected officers functions for the next 12 months. For the year just ending the profits of the sales' stand were so great that each full-term member who participated in the distribution received $1.16 more than he paid in. So here is one plant, that in addition to protection in case of sickness, and insurance in case of death, is able to show an attractive return on the money invested at the end of the year after discounting the money paid out as benefits. A nominal sum is paid the secretary and the treasurer, and these officers are bonded. Members who have collected more than two weeks sick benefit during the year do not share in the distribution. —SAMUEL KAUFFMAN.

OUR shop has a mutual aid society that has been in successful operation for 9 years. There has never been need of special assessments, and at one time there was enough surplus to declare a dividend.

Each member can take insurance shares to equal 60 per cent of his wages. For every share taken the member pays 5c. weekly. This amount is deducted by the shop paymaster each week and turned over to the association treasurer. In case a member is disabled he receives $3.00 benefits each week for each share that he holds. Benefits are paid for a period of 15 weeks after the first week of illness and not to exceed 15 weeks in one calendar year. There is no death benefit provided, since the company carries a group insurance on each employee.

There are eight directors, four being elected each year in such a way as to have each department represented. The company appoints one representative to sit in the directors' meetings, which are held weekly at the expense of the company. The directors then elect officers from their own number. There is a small sum paid to the secretary and to the treasurer each month to partly compensate them for their work. Each month a financial report is posted. The last monthly report showed 110 members in good standing. —RALPH N. STRYKER.

Advantages of Foremen's Clubs

THAT a foreman could learn a great deal from discussion with other foremen of the problems common to foremen, cannot be denied, but in practice it doesn't seem to work out that way. This city has over 1,400 foremen in various industries, and for several years an endeavor has been made to form a foremen's club, but with little success. Various schemes have been tried. Reputedly successful clubs have been copied, professional organizers have been hired, the club has been carried to the plant, with banquets, trade trips, co-operation with leading citizens, but all have failed. Most of the foremen's work is in the supervision of technical operations. Each industry has a different technique, therefore the only problems that can be discussed in meetings composed of foremen from various industries must be on such things as the betterment of working conditions, building of morale, and kindred subjects. Nearly every foreman is convinced of the value of good working conditions, but the working conditions are very seldom left to the judgment of the foreman. He is usually obeying orders, and doing the best he can, and so he soon feels that the abstract discussion of such a subject cannot help him much, and he ceases to attend. The conclusion reached, is that foremen, as a whole, are not interested, or cannot grasp abstract discussion, and that a club composed of foremen from different industries will not succeed unless the members are bound together by some other tie than the interchange of ideas on the handling of men. However, these objections may not apply to a club where all of the members are foremen in the same class of business, as I have had no experience with such a club. —A. HENDERSON.

I THINK that Ed shows a narrow-minded attitude in regard to so-called shop secrets. The knowledge of the world today is the result of centuries of thinking and the exchange of thoughts. Except in the case of strictly competitive shops, a club where ideas could be exchanged would be beneficial. There are none of us so wise that we cannot benefit by the viewpoint of others. Machine shop problems are much the same everywhere. Therefore, if Ed knows of a better method of chasing a thread, and tells John of the shop

THE · NEXT · TOPIC

Is the Company Picnic a Good Thing?

QUESTIONS

What are the points in favor of and those against the Company picnic?

Should, or should not, work and social life be entirely separate?

down the street about it, and John tells Ed something that he had not known about the care of belts, then the exchange of knowledge has been beneficial to both foremen, and their respective shops will profit by the knowledge thus gained. —H. O. LEHMAN.

Who Should Select New Equipment?

THE most successful method of selecting new equipment is the one in which the foreman of the department is asked which machine, in his opinion, is the best for his work. This method has everything in its favor, for who should know better the faults and failings of the equipment? Then, when the foreman discusses the merits of different machines with his assistants, an entire agreement is accomplished. The superintendent or foreman who adopts these methods has nothing to lose, but much to gain. It keeps him and his men up to the minute, searching for better equipment, ever eager for next week's copy of his trade paper.

—C. L. HENRY, *England.*

RESULTS are what count and, when you are selecting new equipment, if consulting the man who is to run the machine will improve results; then by all means consult him, but remember that he may not always run it, so avoid settling the matter by personal preference, since the next man may favor a rival make.

There is a tendency, on the part of the man who has worked on one make of machine, either to see all the good points, having become so used to avoiding the week points of the machine; or to remember all its faults and consider that any make of machine, that does not have these particular faults, must be better. The opinion of the man who has operated machines of different make is always worth having, although a later model may have points with which he is not familiar.

If the workman and the foreman can see rival machines in operation, discuss their merits, and agree that one is best for their purpose; that is the best way to arrive at a final choice. If this selection is not the one the foreman first thought of, it need not detract from his influence because even a foreman cannot be expected to know more than all his men put together.

—ALBERT GUYLER, *President.*

Getting Information from Salesmen

THE average buyer often looks upon salesmen as a nuisance. This attitude is largely due to the fact that many salesmen spend too much time in stating their proposition. Anyone who is in contact with representatives from other concerns will be able to benefit from the time spent in talking with them, if he will look upon them just as Al does. The real sales' engineer is a traveling consulting engineer, and I owe many good ideas from suggestions offered by salesmen who were given an opportunity to look at the job and get all of the facts.

Every technical man realizes the value of the knowledge and experience that could be gained from a few months spent in an institute maintained for the purpose; yet few are cognizant of the fact that this information is being brought to them by the sales representatives of the metal arts. The good sales engineer is competent to answer any question concerning his line, and also able to analyze a job, and select the tool best suited to the work. On the other hand, the buyer of tools and equipment may have a working knowledge of all the phases of machine shop practice, but he is rarely an expert in each branch. It is, therefore, only logical for him to avail himself of the free services of the sales engineer when he has an unusual problem.

I am always anxious to meet salesmen who know their business, because contact with them is one way of being advised of the latest developments, of learning new methods, and of keeping abreast of general business conditions. From my own experience, I have found that it is time well spent to interview every representative who calls. Many of the best suggestions I have received have been the outcome of a chance remark made by some salesman. —HARRY KLINE.

AL IS more fortunate than most of us, for while I note a decided trend toward improvement in salesmen, I still find most of them are doing fine if they know about their own product and its applications. As more and more salesmen are recruited from technical fields the situation is bound to improve, but at present I am quite content to get detailed, accurate information about his own product from the average salesman, and don't hope for anything more.

So like Ed I'm just a bit skeptical, but if the Gods should smile on me and send me the exception, I'd be thankful, and I certainly would use him. It's a long way from the days of high-powered "persuasive salesmanship" to the real sales engineer, and even though I am a bit hesitant in feeling a new era is here, I'm open to conviction if the right sales engineers will come my way. —W. T. VAN HORN.

I AM in favor of encouraging good salesmen to inspect my shop. I do not mean the book kind, but the real mechanical men that thoroughly understand their machines and can give you mechanical answers to your questions. I have gained new ideas from them which have given me food for thought. Some of these ideas were not used at the time, but helped out later. In traveling around the country salesmen get a chance to see things done in many ways, while we do not get that opportunity. If they impart their knowledge to us we receive help from them.

I bought a universal grinding machine that was highly recommended to me, but in using it trouble was experienced in making it grind parallel and true. After trying several methods to find the defect without results, my confidence in the machine was almost lost. I sent for the salesman and explained my troubles to him. Being a genuine mechanic with 20 years' experience in shops, he took off his hat and coat, rolled up his sleeves and went to work in a way that was a pleasure to see. After some experimenting he discovered the defect, sent to the factory for some new parts and rectified the trouble to my complete satisfaction.

You can generally tell the differences between salesmen by a few minutes' conversation. When you are visited by a man of Timmins' calibre, I say welcome him. —J. HOWARD STUDHOLME.

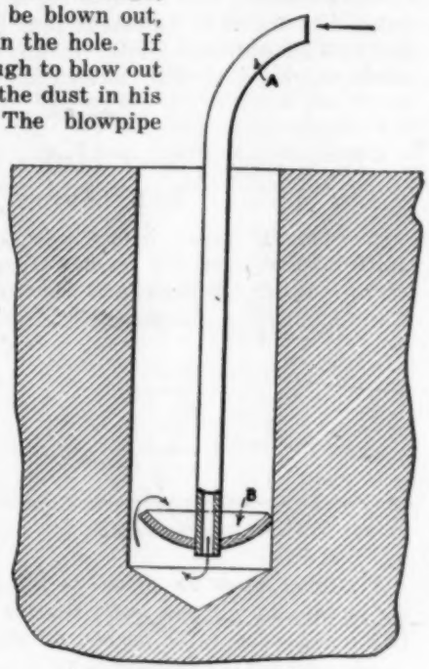
Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Chip Blower for Deep Holes

BY C. A. MARTEN

In using a piece of small tubing as a blowpipe to blow the cast-iron chips and dust out of holes, the drill-press operator is lucky if he does not get an "eye-full." If he does not blow hard enough, only the dust will be blown out, leaving the chips in the hole. If he blows hard enough to blow out the chips, he gets the dust in his face and eyes. The blowpipe shown in the sketch is an improvement on the plain tube, and can easily be made by any machinist. It consists of the tube *A*, which is preferably of brass or copper, and the shallow bowl *B*, slipped over the pipe. The bowl can be made a snug fit on the pipe, allowing its removal and the substitution of others bowls of such diameters as will suit holes of varying sizes. The air travels as shown by the arrows, and the chips drop into the bowl.



An improved chip blower

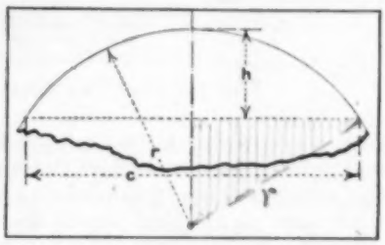
Method of Finding the Radius of a Segment of a Disk—Discussion

BY B. WARD

London, England

Men like myself, with some pretense to the status of engineers, or at least a front-rank mechanics, are not always blessed with a working familiarity with mathematics, particularly trigonometry. The only redeeming feature of such an unfortunate position is that a way is generally found, which, if not quite as picturesque nor as elaborate as the work of experts, gets one there just the same—and in good time.

The article by Leo Laubmeyer under the title given above on page 307, Vol. 66, of the *American Machinist*, is of close interest, but I ask, in ignorance, is not this method a long way around? I have bungled through similar problems on large jobs such as inaccessible winding drums, rope sheaves, and flywheels using the simple procedure indicated below.



Finding the radius of a segment of a disk

As large a segment as possible is secured and the length of its chord and its height carefully measured. Halve the chord, square the result and divide that by the height of the segment; then add the height of the segment for the final answer, the diameter. With reference to the sketch, where c is the chord and h its height

$$\text{Diameter} = h + \frac{\left(\frac{c}{2}\right)^2}{h} = h + \frac{c^2}{4h}$$

For example: A segment of a rope sheave has a chordal length of 12 ft. and is 2 ft. high. Half the chord is 6, which, when squared, is 36. Dividing this by the height 2, we get 18, and adding the height, we arrive at the answer, 20 ft. diameter.

$$\text{Proof: } r^2 = (r - h)^2 + \left(\frac{c}{2}\right)^2$$

$$r^2 = r^2 - 2rh + h^2 + \frac{c^2}{4}$$

$$2rh = h^2 + \frac{c^2}{4}$$

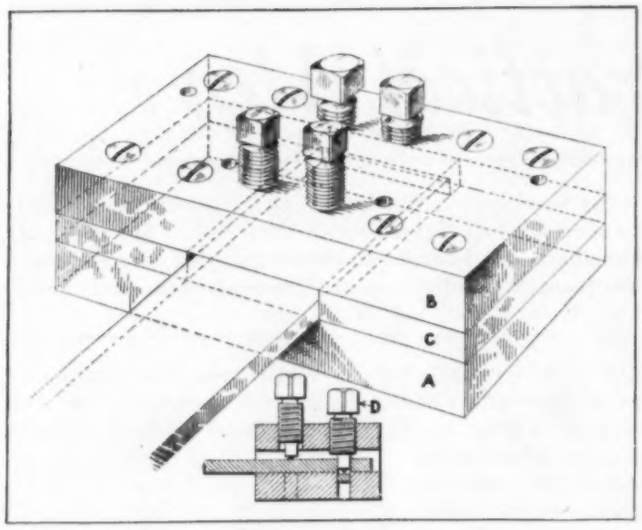
$$2r = d = h + \frac{c^2}{4h} \qquad \text{Q. E. D.}$$

Hand Punch for Busbar Contacts

BY FRANK WALDO

In assembling switchboards, a number of bolt holes have to be drilled in the busbar contacts. The fitting is usually done at the power house, or station in which the switchboard is being installed, and seldom is there a drill press available for the drilling. A hand drill often is used, but unless precaution is taken in laying out the work, as well as in the actual drilling, inaccurately spaced holes will result. To overcome the possibility of improperly spaced holes, the hand-operated punch illustrated, was made.

The die plate *A* and the punch holder *B* are assembled



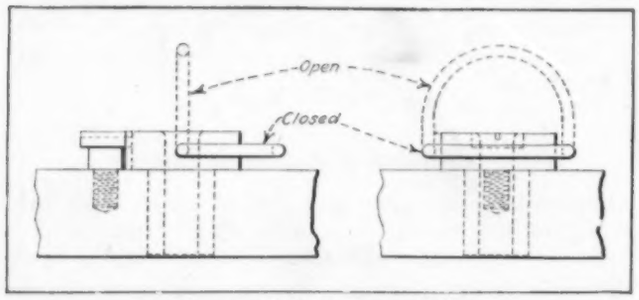
Tool for punching busbar contacts

with guide plates *C* so that the opening in the center will permit the insertion of the contacts. The bodies of the punches *D* are threaded and the ends are provided with cone points that imbed themselves in the copper for centering purposes. A wrench with a long handle is used to screw the punch through the metal. All the parts are hardened with the exception of the guide plates. The die plate can be resharpened by grinding the top face and, likewise, the punches can be ground on the ends when they become dull.

Slip Bushings

By E. Hampshire

One of the most fruitful sources of annoyance to a drill press operator is the "slip" bushing, the trouble being that it does not always slip. The operator turns it as much as he can by gripping the knurled head, then he usually tries to pry it out with a screwdriver. He may get it loose and he may cut his hand. If it can't



Slip bushing for a drill jig

be pried out he usually starts to hammer sidewise on the knurled head, often resulting in a broken bushing. A slip bushing, should fit close, and a little dust will make it very hard to remove.

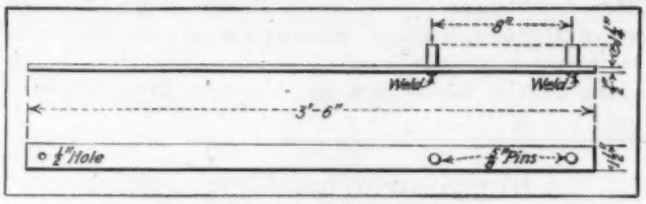
I have used very successfully the bushing shown in the sketch. It has a little bail, or handle, and no knurling. It does not look so nice as the knurled variety, but the handle is very effective means for loosening the bushing either by turning or prying, and when folded it does not interfere.

The bail is made from cold-rolled steel fitted in holes in opposite sides of the head.

A Faceplate Remover

By Edwin Kilburn

In order to remove lathe faceplates easily, we make use of the appliance shown in the sketch. This one is suitable for a 16-in lathe. The bar is of flat, mild steel, the pins are of cold-rolled steel and should be very



Tool for removing faceplates

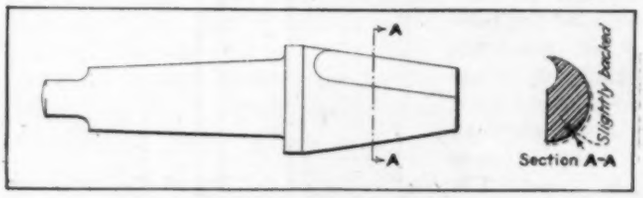
securely fastened. Welding to the bar on the back side as shown makes an excellent fastening. The manner of use is obvious.

A combination tool suitable for a variety of sizes of plates may be made by fitting pins of different diameters and at different center distances at the opposite end of the bar where the sketch shows a hang-up hole.

Reaming Taper Holes in Copper

By H. Lameck

In reaming taper holes in copper, the ordinary multi-fluted reamer will become clogged and will either tear or chatter the work, and sometimes it will do both.



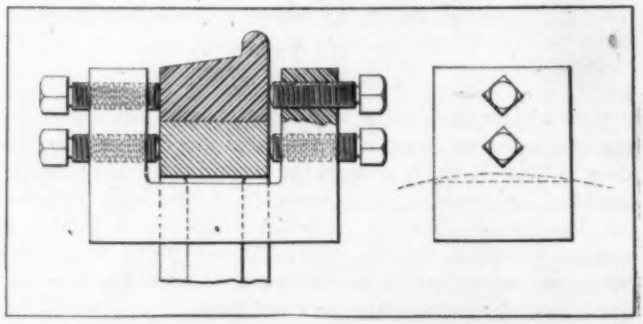
Taper reamer for copper

A reamer made as shown in the sketch will peel off the metal and will not leave chatter marks in the hole. The reamer should be backed off slightly as shown.

Clamps Help in Shrinking Locomotive Tires in Place

By Louis L. Locke

In shrinking tires to driving-wheel centers, difficulty was experienced in obtaining true-running assemblies with the usual equipment, so that it was necessary often



Clamp that aids alignment in shrinking tires

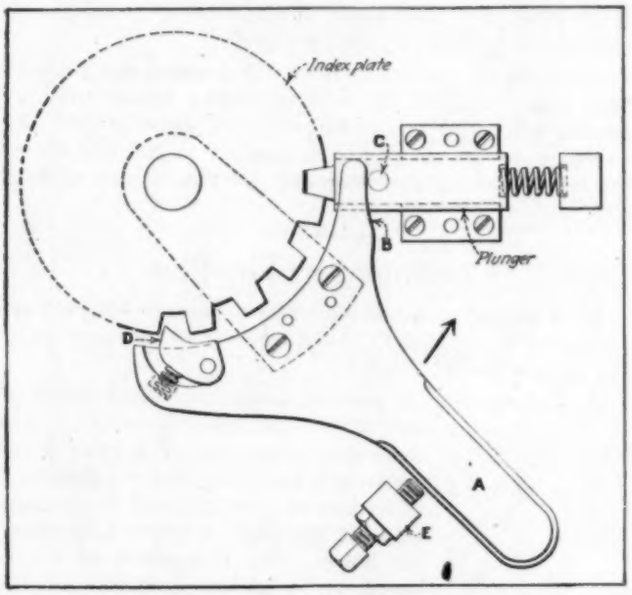
to reheat the tires after they had set, then make a readjustment in order to true them up. However, since using a set of clamps such as the one illustrated, this difficulty has been overcome.

The clamps are used in the following manner: After the tire has been heated and placed on the center, six clamps are located at equal distances around the tire and center. Setscrews, two on each side of the clamp, are adjusted to align the tire and the center so that after the tire shrinks in place, there will be little chance for misalignment. Four clamps will suffice in setting tires of smaller diameters.

Semi-Automatic Indexing Device For Fixtures

BY GEORGE H. FELTNER

The illustration shows a semi-automatic indexing mechanism for use in connection with jigs and fixtures. The spring plunger, shown at the right, locks the index plate. When the lever *A* is moved in the direction shown by the arrow, the horn *B* strikes the pin *C* and withdraws the plunger. At the same time, the pawl *D* is moved to the next notch, so that when the handle is



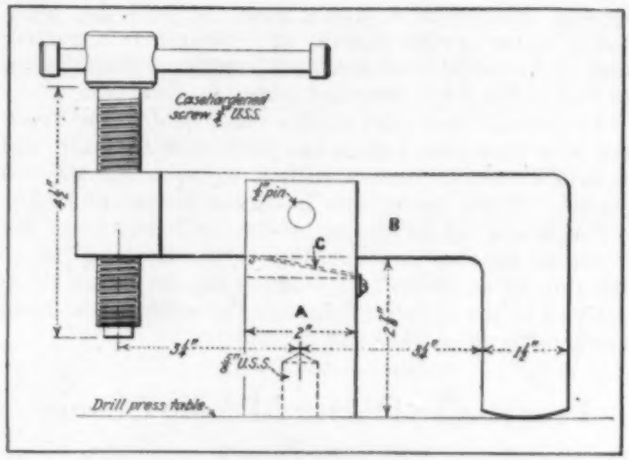
Indexing mechanism for jigs and fixtures

moved in the reverse direction, the index plate is revolved until the plunger enters the next notch and locks it. The adjustable stop *E* limits the movement of the handle on the return stroke. With slight modification the device can be made to operate any given number of indexing positions. The feature of the device is that one movement only is required to index and lock the plate.

A Clamp for the Drill Press

BY S. B. RICHEY

The illustration shows a convenient clamp for use on the drill press. It is attached to the machine table by a screw passing through one of the slots or through a hole drilled at a convenient point in the table, and



A convenient clamp

threaded into the lower end of the upright member *A*.

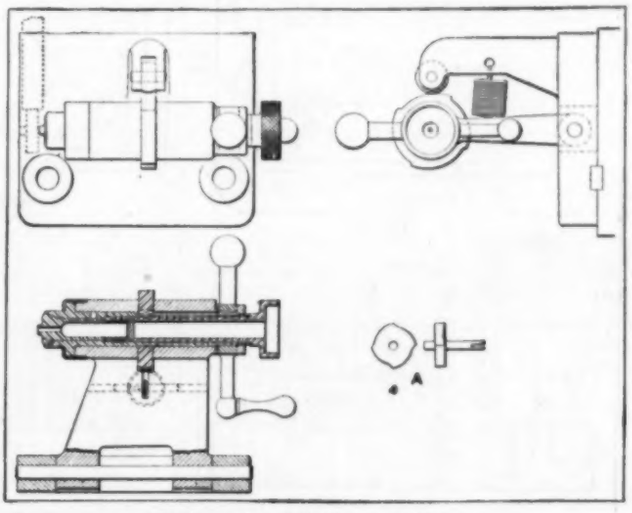
In drilling, the work is centered under the drill while loose and is then clamped in place. There is sufficient room under the screw for clamping a small machine vise. The principal dimensions of the clamp made by me are given in the sketch. The part *A* can be made of either round or square steel. The part *B* is upset at the end where it is tapped for the screw. The flat spring *C* holds the clamp in the release position when the work is being put in or removed.

A Fixture to Grind a Cam

BY B. J. STERN

The fixture here shown was devised for the purpose of grinding the active face of the small cam shown at *A* after the lathe work upon the latter has been done and the piece hardened. As will be seen, the cam has four equally spaced divisions, the curve of each having a gentle rise of $\frac{1}{16}$ in. only, of which fact advantage was taken in designing the fixture.

The fixture is mounted on the table of a tool grinding machine, to which it is secured by a clamp and aligned by means of the key in the base. Pivoted upon a long pin that passes clear through the base casting is a swinging bracket at the top of which is a rotating



Fixture to grind a small cam

spindle fitted with a spring collet to hold the work. Keyed to the spindle midway of its length is a master-cam of hardened steel having a contour corresponding to that of the work piece but larger in diameter.

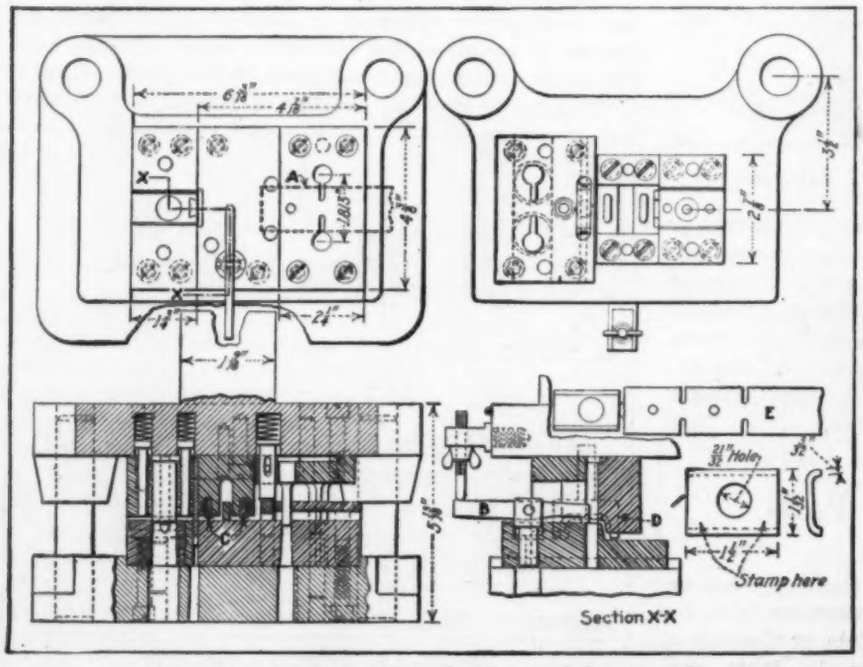
The master-cam rides upon a roller held in the upper end of a fixed arm, cast in one piece with the base, and is held always in contact with it by means of the coil spring. When the spindle is turned by means of the crank handle an oscillating motion is imparted to the swinging bracket corresponding to the rise and fall of the cam to be ground. By adjusting the fixture with relation to the grinding wheel of the machine the cams can be ground quickly and accurately.

Progressive Die for Making Clamps

BY GENE PHELPS

A well-designed progressive die for making ⅜-in. steel clamps is shown in the illustration. The operations performed are piercing, lettering, forming and cutting off. In operation, the strip material, 1⅞ in. in width, is inserted to the position *A*, in which location two ¼-in. notches and a 0.255-in. hole are pierced. Then the strip is shifted to the left so that the finger stop *B* locates it from the previously pierced center hole, in which position two impressions are stamped by the stamps *C* on the top face.

Progressing the work along another length, brings it in line for the last step, that of forming, re-piercing the hole to ⅝ in., and cutting off the connecting stock left by the two notching punches. Each stroke of the press completes a part after the strip has reached this position. The purpose of cutting the two notches is to allow the formed piece to be cut off with tools of simple shape. The strip is centralized by the equalizing plunger *D*, attached to the punch holder by a shank and a light helical spring. As the punch descends, the angular faces of the plunger strike the strip prior to any of the punches and, likewise, correct any misalignment that may exist. At *E* is shown the layout of the stock as it is pierced and shaped by the three stations.



Layout of a progressive piercing and forming die

Practical Shop Problems

Questions of a Practical Nature will be answered in this column

Wet Versus Dry Grinding of High-Speed Steel

Q. Should high-speed tools be ground wet or dry?

A. The merits of wet and dry methods of grinding high-speed steel are still debated. Both are successful, but the tendency is more toward wet grinding at present. When grinding wet, a copious stream of coolant should flow at low velocity directly upon the nose of the tool. Five gallons per minute is a satisfactory rate of flow. A little water is far worse than none at all, as such a condition is the direct cause of checking in many cases. The tool should not be forced against the wheel too hard, as the water is thus temporarily kept away from the work surface so that when the tool is released, the cool water strikes the hot metal and causes the surface to crack.

Paste for Labels on Castings

Q. What is a good paste to stick labels upon smooth, clean castings for shipping purposes?

A. A cheap shellac varnish will answer the purpose very well. Apply to the casting with a brush, then lay on the label and rub down with the same brush. By so doing a coat of shellac is applied to the surface of the label, making a waterproof covering which effectually protects it from rain.

Coatings for Tin Plate

Q. Will you please explain the difference between tin plate and terne plate? Also, what is the proportion of tin on common tin plate?

A. Commercial tin plate is made from black plates of soft steel, and covered with a thin coating of pure tin. The chief point in manufacture is to secure a thorough adherence of even coats of tin on both sides of the plate without blisters or pin holes. The proportion of tin is based on a given quantity of the finished product. A box of 112 sheets, 14x20 in., weighing approximately 100 lb., has 1¼ lb. of tin in the coating. This is a standard product, but heavier coatings are also applied. Terne plate is a soft-steel black plate covered with a coating of an alloy of 80 per cent lead and 20 per cent tin. Both tin plate and terne plate are manufactured by the hot-dip process using palm oil as a flux.

To avoid crystallization shrinkage in die-castings, use as low a metal temperature as possible. It is considered better to increase the heat of the die rather than of the metal. In addition to avoiding the crystallization shrinkage, the casting will be more nearly true.

Cam Curves in Common Use

The cam chart, Fig. 1, is a rectangle, the height of which is equal to the total motion of the follower and the length equal to the circumference of the pitch circle of the cam. On it are drawn the base curve, which becomes the pitch *surface* of the cam, and the pitch *line*, which becomes the pitch *circle* of the cam.

The pitch line passes through the point on the base curve that has the greatest slope, starting from the bottom of the chart. Hence the pitch circle of the cam itself intersects the pitch surface at the point where the cam has the greatest side pressure against the follower.

The *working* surface of the cam is that part with which the follower is actually in contact and, therefore, coincides with the *pitch* surface only when the follower has a V-shaped edge. With a roller follower, the working surface is the envelope curve to a series of arcs equal to the radius of the roller and drawn with their centers on the pitch surface. In Fig. 2 this is indicated.

The base curves most commonly used are a straight line, a straight-line combination, a crank curve, a parabolic and an elliptical curve. The straight line base curve, Fig. 3, gives infinite acceleration and deceleration, and hence shock, but has uniform velocity, once under way. The straight-line combination curve, Fig. 4, being rounded off at the ends, eliminates the shock but still has relatively high acceleration. The crank curve, Fig. 5, gives a slightly irregular increasing velocity to the follower from the beginning to the middle of the stroke with a similar retardation on the return stroke. The acceleration is relatively small, but not quite as much so as that of the parabolic curve, Fig. 6, which gives a uniformly increasing velocity from beginning to the middle of the stroke. The elliptical curve, Fig. 7, on the other hand, gives slower starting and stopping velocities but a higher velocity at the midpoint. The acceleration is variable, being maximum at the middle, but this is less than that of the straight-line combination curve at start.

In the accompanying illustrations, the various charts are laid out for a maximum pressure angle of 30 deg. and for action during 120 deg. of rotation. The lengths of the cam charts have been proportioned to give equal maximum pressure angles in each case. Values for other angles are given in the table. The pitch radius r is found as follows:

$$r = 0.159\frac{hf}{e}$$

Table of Cam Factors

	—Factors Corresponding to— Maximum Pressure Angles				
	20°	30°	40°	50°	60°
Base curve	20°	30°	40°	50°	60°
Straight line	2.75	1.73	1.19	0.84	0.58
Straight-line combination	3.10	2.27	1.92	1.77	1.73
Crank curve	4.32	2.72	1.87	1.32	0.91
Parabola	5.50	3.46	2.38	1.68	1.15
Elliptical curve	6.25	3.95	2.75	1.95	1.35

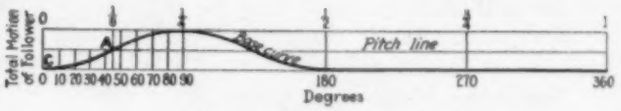


Fig. 1—Typical cam chart

where f is the chart factor; h the total lift of the cam follower, in the present examples, unity; and e is the fraction of a revolution turned by the cam during the actual follower motion, in these examples one third. The construction of the charts is self-explanatory. It is important to note, however, that equidistant points are laid off on the arc of the circle and also the arc of the ellipse and that these points are projected horizontally to vertical lines erected at equal intervals on the chart. In transferring the curves on the charts to the cams, the vertical distances of the points on the curve from the pitch *line* of the chart are laid off radially from the pitch *circle* of the cam at equal intervals, corresponding to the chart divisions. In the present examples, the active surface is divided into eight parts, or at 15-deg. intervals.

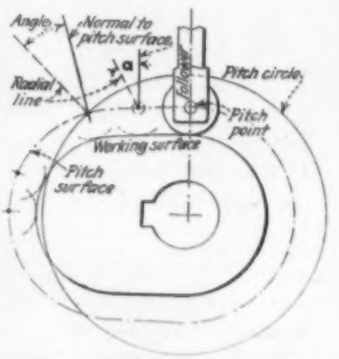
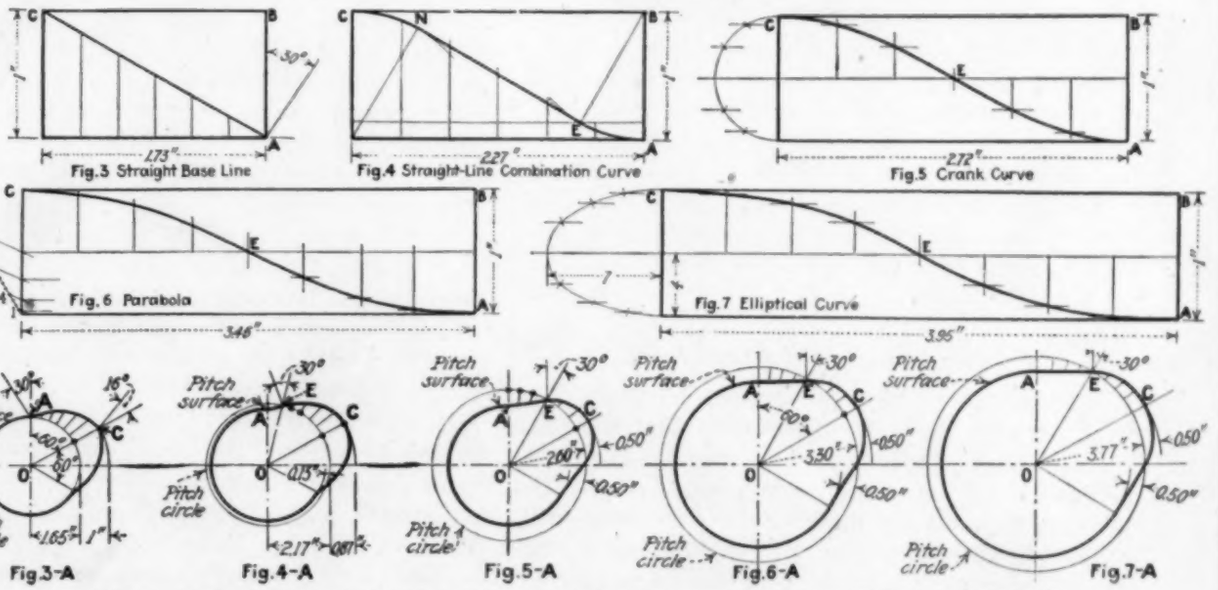


Fig. 2—Cam nomenclature



NOTE: Scale of Figs. 3-A, 4-A, 5-A, 6-A and 7-A is about one-sixth that of Figs. 3, 4, 5, 6 and 7.

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Balanced Executives

CRANKSHAFTS must be balanced, if they are to run properly, and so must flywheels and armatures. Everyone admits this fact but there are still many people who do not realize that an executive of a big company, or a small one for that matter, must be even better balanced if he and his company are to be successful.

Not long ago a large company decided to round out its line of products by buying a much smaller company in the same town. The product of the small company was apparently well enough made and its popularity was attested by orders on the books amounting to a comfortable sum. The man who arranged the merger was a thorough salesman and he knew the value of orders on the books. Unfortunately, he was not so well grounded in production matters and when the details had all been arranged it was discovered that the small company had a shop equipped principally with museum antiques.

The equipment was hopelessly inadequate either to manufacture the quantity needed to fill the orders or to operate efficiently enough to make a profit. There was only one thing to do and that was to re-equip the plant throughout with modern machinery. It will take some time to absorb the cost.

This incident is quoted to show what may happen if an executive, instead of being well balanced, is a brilliant specialist in only one phase of manufacturing activity. It is no more reasonable to expect a salesman with no production experience to function successfully as the head of a manufacturing corporation than it is to expect a production man without a sales background to do the same thing. And both of them would be at sea without some financial experience as well.

Bunk About Old Machines

OF ALL the bunk that inflicts the human race perhaps the particular brand that glorifies the past at the expense of the present is the most pernicious. That there were great artists and workers in wood and metal in the past none will deny. But the average of workmanship was much lower than at present. Examine one of your old family heirlooms with the critical eye you use on present day products and in nine cases out of ten you will find workmanship you would reject in your own shop.

In a recent instance a visitor wanted parts for a lathe made by a concern that had been out of business for thirty years. "Must have been a good lathe—they don't last that way now," was his illogical comment.

The reverse is true. While many machines built thirty years ago were good for their day, they survive simply because they have never been used as high production machines. If one of these "good old lathes" were put in the production line of a modern plant it would be ready for the cupola in a short time.

All credit to the old builders of machines. They built well considering materials and facilities. But the idea that machines were ever built better, or even as well as at present, is not only erroneous but harmful.

National Fire Prevention

AS A country, the United States is painfully indifferent to fire losses. Plenty of statistics are available to prove this statement. For instance, the annual cost of fires, 90 per cent of which are preventable, is 12,000 lives and half a billion dollars in property.

Who pays for the losses? The lives can never be replaced; there is general agreement on that point and some measure of realization of the tragedy involved. But when it comes to property loss the answer is usually a shrug and the careless statement, "I'm insured."

Insured—yes, but who pays the premiums? Not the insurance company, its function is to collect from all the people enough money to pay for the losses sustained by the unfortunate or careless ones, and enough extra to cover the cost of the collection and provide a profit. Those who pay the premiums contribute to the general fund out of which losses are met, and they must pay well no matter how careful they themselves may be because others are not so careful and make the risk a serious one.

The need for education of citizens and business men in the simplest fundamentals of fire insurance and the basic principles of fire prevention is obvious. Such a movement has been started by the National Fire Protection Association and deserves the hearty support of every corporation and individual. A fund of $500,000 is being raised to extend the scope of the educational campaign which has proved eminently successful on a small scale. The national chairman, Irving T. Bush, believes it possible to reduce the fire losses in any community from twenty-five to fifty per cent in five years. Fifty per cent of $500,000,000 is worth saving.

Technical Abstracts

Unsatisfactory Finish in Grinding

Under heavy cutting, or where the grinding wheel is too hard or is glazed, resulting in a high pressure upon the wheel in the attempt to make it cut, feed lines are almost certain to be produced. A change in speed, use of sufficient number of steady rests, or the selection of a wheel adapted to the work will remedy spirals. Correct truing of the wheel is important, inasmuch as the cutting action is greatly affected by the condition of the wheel face.

Experimenting with different truing speeds, the number of passes of the diamond over the wheel, and the depth of cut per pass may result in the improvement of its action. The manner of feeding the wheel into the work and the table traverse speed used are also factors worth considering when trying to eliminate spirals. When the grinding wheel and grinding methods are correct for the work and feed lines are being produced the trouble probably lies in the machine. Errors in the alignment of the wheel spindle in relation to the table ways, or a bow in the table ways, are the factors in the machine which cause heavy cutting by the wheel corner, which makes a spiral line on the work.—C. H. Hill, *Abrasive Industry*, April, 1927.

Fatigue of Welds

To ascertain the ability of welded parts to resist fatigue, particularly thin-walled tubes of the type used in airplane fuselage construction, a series of tests was run at McCook Field. The material tested consisted of ½-in. and 1-in. cold-rolled, seamless tubes of 1025 steel, and of arc-deposited pads of Norway iron and steel Kote welding rod. The specimens were tested to destruction in a rotating-beam type of fatigue testing machine that subjects them to flexural stresses passing through a complete cycle from tension to compression, equal in magnitude.

Although the tensile efficiency of the welded tubes was better than 75 per cent, the fatigue strength was as low as 13 per cent and never higher than 35 per cent of the tensile strength of the weld.

Poor fusion has a drastic effect upon the resistance of the weld to repeated stresses. Poor fusion may not be detected by the tension test, but is detected by the fatigue test.

The ½-in. diameter welded tubes showed a better resistance to fatigue than the 1-in. diameter tubes, probably because welded more uniformly.

The endurance limit developed by specimens from solid deposits of weld could not be equaled by the welded tubes. This is probably due to a difference in structure caused by the more rapid cooling of the relatively thin weld metal joining the tubes.

The deposited gas weld showed an endurance ratio as good as found on most steels. The deposited arc weld and atomic hydrogen weld were somewhat lower.

The "piling up" of the weld may operate to lower the resistance to repeated stresses due to locally intensified stresses set up by the sudden change in cross section.

Long time fatigue tests show that the deposited metal has a definite endurance limit just as is found in steels.—R. R. Moore, *Journal of the American Welding Society*, April, 1927.

Design and Construction of Taps

As the chamfer of a tap that is not ground in the thread is often ground after hardening, and as the tap is at that time more or less crooked (in spite of all efforts that have been made to straighten it after hardening), the chamfer will be uneven and of different length on the different lands of the tap. As a result, some of the lands will not do their share of the work in tapping, while others will be overloaded and wear faster. It must be borne in mind that the chamfered part of the tap is the part that does the cutting and is, therefore, of the utmost importance as far as the cutting qualities of the tap are concerned. Hence, the effects of incorrect chamfer are serious, and improperly chamfered taps will wear quickly and break easily. If the chamfering is done before hardening, concentric with the threads, the results will still be unsatisfactory, because the tap bends more or less during the hardening operation and can never be entirely straightened.—A. L. Valentine, *Machinery*, April, 1927.

Use of Electric Drills in Maintenance and Repair Work

To drill a ½-in. hole in mild steel, or cast iron, is a tiresome job when done by hand and it is often impossible, or too costly, to take the work to a drill press. A carbon-steel twist drill can be operated in such material at a cutting speed of 40 ft. per min., which is about 300 r.p.m. for a ½-in. drill. In passing, it is convenient to remember the following rough-and-ready rule for determining the practical speed for any size of carbon-steel drill used in mild steel: R.p.m. = 150 ÷ diameter of the drill. Three hundred revolutions per min. is a much higher speed than can be obtained for any appreciable time with a hand-driven, ½-in. drilling device.

If we apply the above rule to find the speed for a ⅜-in. twist drill in mild steel we get 150 ÷ 0.375 in. = 400 r.p.m. It is apparent therefore that the drilling machine should be capable of operating at various speeds to obtain the best performance over a wide range of work found by the maintenance mechanic. Most electric drills are equipped with a motor which accomplishes automatically this adjustment.

Contrary to first impressions, to turn a twist drill in wood requires more power than does the same drill in steel or other metals. This condition exists because such a pit does not clear itself readily. The remedy is to withdraw it every inch or so of depth in order to clear the hole. When holes are to be drilled in wood, it pays to have proper bits. The ordinary wood bit with the lead screw is not suitable unless the threads are ground off leaving a point for centering only. The machine-type wood bit is more suitable.

Although an electric drill does not make a thoroughly practical grinder, or scratch brush, it may be used for numerous odd jobs of this nature.—Edwin L. Connell, the *Industrial Engineer*, April, 1927.

Theory to Explain Abnormal Steel

The possibility of selecting suitable material for carburization from a shipment of steel, before manufacture, is of industrial importance.

Since there is little information regarding the interpretation of the McQuaid-Ehn test, consumers of steel have concentrated their attention on the study of microscopic images of specimens carburized according to the specifications of the test. Misunderstandings and trouble result when observations revealed in this test, which involves several variables, are incorporated in specifications submitted to the manufacturers of steel.

An investigation to discover the true cause of non-hardenability was made. Commercial practice, involving tap-water quenching, was duplicated so far as possible. Steel that would not harden uniformly in tap water was designated as abnormal.

Many thousand samples from several hundred heats were checked for their microscopic appearance, all phases of heat-treatment and carburization being taken into consideration.

The assumption, generally accepted, that small grain in steel is inducive to hardening troubles was not borne out in the tests; although, during the study of casehardening, it seemed apparent that a greater depth of case was obtained with large-grained steels.

Further microscopic examination led to the conclusion that non-hardenability is caused by the presence of an excessive amount of oxygen in the steel. All specimens, not having in them any iron-carbon-oxygen alloy, discernible under the microscope, will harden satisfactorily. The presence of this substance can be detected in a fraction of the time required for the determination of grain size.—John D. Gat, *The Iron Age*, April 21, 1927.

Shop Equipment News

New Britain No. 23-A Automatic Chucking Machine

THE New Britain Machine Co., New Britain, Conn., has brought out an automatic chucking machine of the tool-rotating type that is a development of the No. 12-A machine described on page 207, Vol. 63, of the *American Machinist*. The new machine has four spindles, is of greater capacity than the 12-A, and has many special features.

It is designed to handle small brass, iron or steel castings or forgings for turning, boring, facing, threading and similar operations. The parts to be worked upon are held in two-jawed screw chucks which are operated by air pressure and automatically controlled by the cycle mechanism of the machine.

The main bearing of the horizontally-mounted turret is 13½ in. in diameter by 10½ in. long. A 4½-in. diameter bar, made integral with the turret, extends from the chuck-face thereof and takes a bearing in the spindle-head of the machine, thus providing support both before and behind the work and eliminating overhang of the latter. The turret is indexed to five positions by a modified Geneva movement and locked in each working position by a radially-sliding bolt of large proportions which is provided with means of adjustment to compensate for wear.

The turret has a longitudinal movement of 5 in. for adjustment only. Micrometer-marked ring nuts on the end of the extension bar furnish means to position the work accurately with relation to the tools when setting up the machine. In operation the turret has no movement other than the intermittent one of indexing and while the tools are at work, it is held rigidly by a clamping device that releases automatically during each indexing movement.

Five 7-in. chucks are mounted upon the face of the turret opposite to the tool-holding spindles. The chucks are pneumatically operated through independent cylinders, pistons, rack-rods and elliptic gears, the latter so disposed as to apply maximum leverage at the instant the chuck-jaws close upon the work piece.

To secure this relation of the elliptic gears to each different size of work-piece the square hole in the gear which fits over the squared end of the chuck-screw is disposed at an angle of 22½ deg. with relation to the major axis of the gear, and the gear itself is invertible. Thus four relations may be obtained by placing the gear in any one of the four possible positions, and four intermediate relations by merely inverting the gear upon the screw.

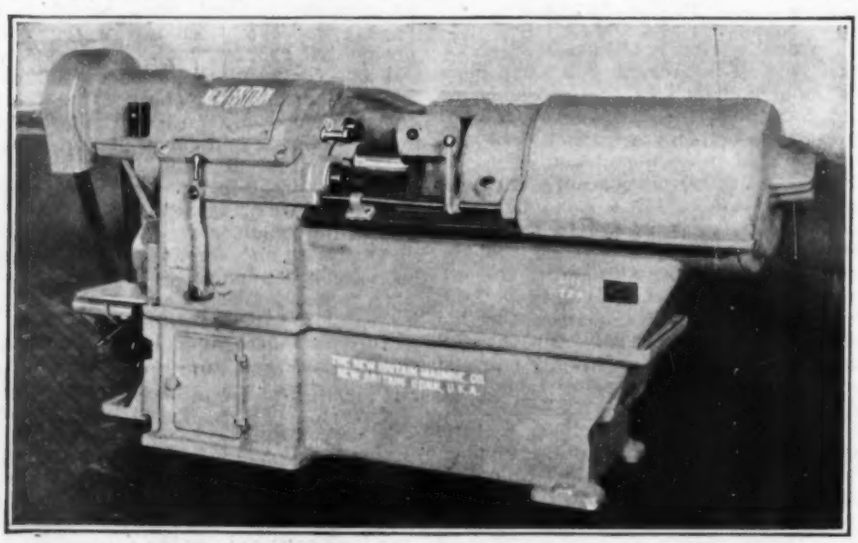

Fig. 1—New Britain No. 23-A Automatic Chucking Machine

Provision is made in this machine to operate the chucks hydraulically instead of pneumatically if so desired. No change is necessary other than to make the ports and passages larger. A separate reservoir in the base of the machine contains the oil for this pnrpose, and a place to attach and means to drive it are provided for the hydraulic pump. When so equipped, the machine becomes an entirely self-contained unit with all power supplied by its own driving motor.

Ordinarily the machine is made with four spindles; three for turning, facing, etc., and the fourth for threading. The face of this latter spindle is set 2½ in. behind the common plane with relation to the turret in order to accommodate the extra length of self-opening die-heads, collapsible taps or other threading devices.

All spindles are of vanadium steel, heat-treated and ground. They run in tapered sleeve bearings of bronze, provided with the usual means of adjustment to compensate for wear. Provision is made in the frame for a fifth power-driven spindle, if desired, opposite to the loading station of the turret. The purpose of the extra spindle is to carry a spotting drill when such an operation would facilitate the work of the succeeding tools.

The first three spindles are driven through helical gearing, the hand of the helix angle being so disposed as to have a retractive effect upon their longitudinal movement. Individual speeds range from 160 to 1,200 r.p.m. in four groups, obtainable through change gears on the outer end of the intermediate shaft. The spindle bores for the reception of tools are 1½ in. in diameter by 3⅜ in. deep, with a 1-in. diameter hole extending clear through. A substantial key in each insures positive drive to the tools.

The longitudinal movement of the spindles, including the quick advance to position and the following feed

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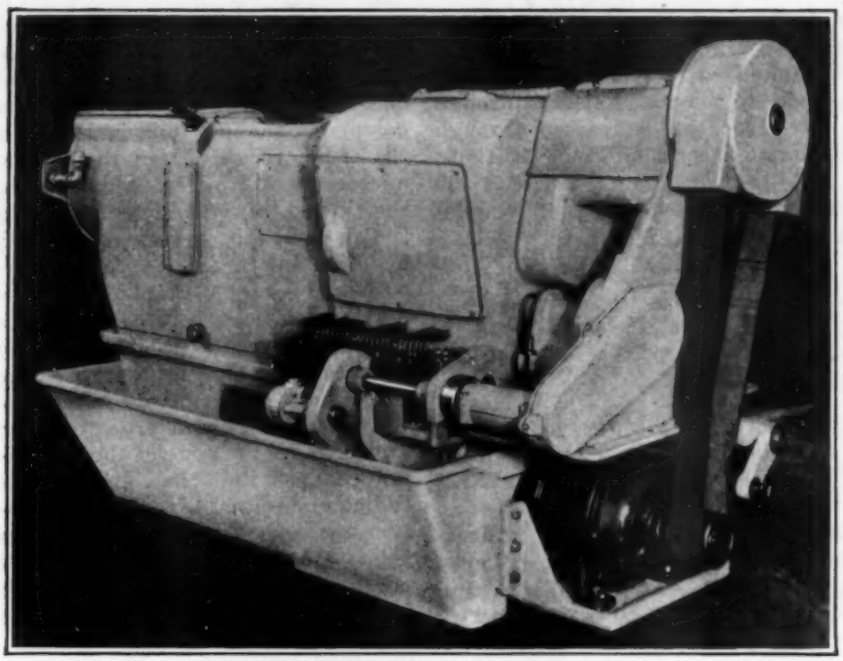


Fig. 2—Rear view of the machine

movement, is actuated by cams in the usual manner. The maximum combined range is 3 in. The minimum gap is 4½ in., and the maximum —with the turret fully retracted— 9½ in. The center distance between the spindles is 6½ in., which thus represents the maximum diameter of tool that can be used; but as the work in this machine does not revolve, this size limitation is not imposed upon work pieces of irregular outline that may overlap.

The threading spindle is driven through clutches. It has a range of speed from 45 to 700 r.p.m., and the return, or withdrawal, is always 1.34 times the forward speed. The relative speed of the threading spindle is alterable through a separate train of change gears to suit the pitch of the thread being cut, and the "hand" may be changed from right to left by the introduction in this train of an intermediate gear without altering the ratio.

A device on the rear end of the threading spindle provides a positive lead by means of a nut and threaded pilot to start the threading tool in the work. As soon as it has started, the nut releases and the spindle is free to be governed by the lead of the die or tap in the work. The tool bore of the threading spindle is 1¼ in. in diam. by 3⅜ in. long, with a ⅞-in. through hole. This bore is also fitted with a key for driving.

The drive to the machine is by belt to a constant-speed pulley at the left end of the machine. A bracket is provided for a 7½-hp. electric motor, which is partly inclosed by the base. A spring-suspended idler maintains belt tension. The cast-iron guard over the drive pulley is reversible and may be turned upward to accommodate a belt from an overhead shaft. When so driven the motor bracket is omitted.

The working parts of the machine are almost entirely inclosed, but all are easily accessible through removable covers. Fresh oil is supplied to the 56 bearings of the machine by an automatic force-feed oiling system. The base is separate from the frame of the machine and contains suitable reservoirs and a circulating pump to provide oil or other coolant for the work and tools.

A front view of the machine is shown by Fig. 1, and in Fig. 2 a rear view. The starting and stopping lever may be seen at the left in Fig. 1, while immediately in front of the operating position is the small lever by which the chucks are controlled.

Ordinarily the cycle is automatic and continuous; the finished piece is ejected from each chuck as it approaches the loading position and the operator has only to place the new piece in position. All cam-actuated movements of the machine may be stopped by a movement of the chuck control lever to the left.

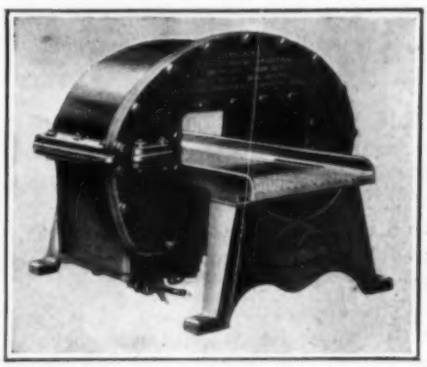
If desired, as in the case of parts that might be injured or marred if allowed to fall from the chuck upon ejection, the cycle may be adjusted to stop after each movement, either before or after indexing. In this case the action is, of course, intermittent, and the operator trips the cycle mechanism by a movement of the lever after he sets each piece in the chuck.

The floor space occupied by the machine is 109x33 in., and the weight is approximately 5,000 pounds.

Blanchard Demagnetizer

The Blanchard Machine Co., 64 State St., Cambridge, Mass., has designed the demagnetizer shown for removing residual magnetism from small pieces such as hardened washers, rings, cutter teeth, tool bits, reamer blades and the like that have become magnetized through being held on a magnetic chuck. The device will handle quantities of such small pieces on a production basis. It is not recommended for single, heavy pieces although the opening will pass a piece 6½ in. wide and 2¾ in. high.

It is said that the coil is designed for maximum effect consistent with safe temperature when operating



Blanchard Demagnetizer

continuously, in which case the coil will show a temperature rise of 85 deg. F. above the surrounding air. It is thoroughly insulated and is entirely inclosed in a brass case so that it is protected from mechanical injury or dampness. The terminals are brought out on the under side in a fitting to take a ½-in. flexible conduit. The coil is wound for use on 60-cycle alternating current of

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110, 220, 440 or 550 volts. The power consumption is about 550 watts.

The pieces are placed on the shelf and slid slowly through the coil. The full width of the shelf may be filled and the groups of pieces can be pushed ahead as fast as more pieces are added, letting the pieces that have passed through fall off the far end of the shelf. If pieces of medium or large size are not thoroughly demagnetized they can be turned around as they pass slowly through the coil or can be passed through more than once in different positions.

The net weight of the unit is 100 lb. Boxed for shipment it occupies a space 19x17x15 inches.

Société Genevoise Pitch-Measuring Machine

THE Société Genevoise d'Instruments de Physique, of Geneva, Switzerland, has put on the market an apparatus for measurement of the pitch of screw threads, which is being sold in the United States and Canada through its American agents, the R. Y. Ferner Co., Investment Building, Washington, D. C.

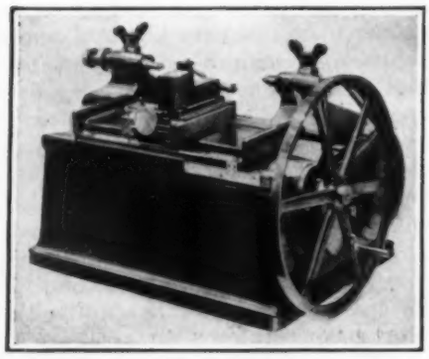

Fig. 1 — Société Genevoise Pitch-Measuring Machine for external threads

This machine is adapted to the measurement of both internal threads, Fig. 1, and external threads, Fig. 2. It will hold plug gages up to 6 in. in diam. and 8 in. in length, and has a travel of its micrometer screw of 4 inches.

The apparatus consists of a bed with ways on which two sockets carrying adjustable centers are mounted for the support of the thread gage. A micrometer slide is moved in separate ways parallel to the axis of the gage under test, by rotation of an accurate screw.

The screw has 10 threads per in. (or a pitch of 2 mm. in the metric instrument) and a large drum mounted on it is graduated in 2,000 divisions so that one division corresponds to 0.00005 in., the guaranteed accuracy of the machine. An auxiliary scale, with index, graduated to tenths of inches, serves to read the larger units of the measurements.

The micrometer slide which is actuated by this lead screw carries an amplifier in which various measuring anvils may be mounted. A knife-edge multiplication system is used in this device, which gives a sensitivity of 0.00001 in. As the slide is advanced along its ways, the measuring anvil moves up and down over the flanks of each thread of the gage, along a line parallel to its axis. An adjustment of the amplifier device is provided at right-angles to the axis of the gage, so that its indicator may be made to read zero at any desired point on the flank of a thread, that is, at any fixed distance from the axis of the gage being tested. By taking readings on the micrometer head at the first setting on any initial thread selected and then taking micrometer readings at the same position of the measuring anvil on the flanks of other threads, the observer is actually taking successive readings for the positions of the thread gage, on the successive thread flanks. The differences of the successive readings will be the actual pitch.

These readings may be taken at the point of effective diameters of thread gages, or near the top or bottom of the thread flanks or other points, as desired. The thread gage is held firmly between the centers during these measurements, without axial play or rotation, but if measurements on the opposite side of the plug are desired, or in other angular positions of the gage, the gage can be turned about on the centers to the new position.

An ingenious device is used for compensating for the errors of the 4-in. micrometer screw. By a pinion mounted on the shaft of the screw a large gear wheel is rotated, which, by a similar pinion on its axis, rotates a second gear wheel. The gear ratio is such that the last wheel makes one revolution in the complete passage of the indicator device along the 4-in. threaded length of the micrometer lead screw. Attached to the axis of this second gear wheel is a disk cam, the curvature of which has been cut in accordance with the measured errors of graduation of the micrometer head. The index mark of the micrometer head is mounted on a sector which is free to rotate on the shaft of the micrometer screw. This sector carries a projecting pin that engages the edge of the correcting cam, so that the variations in radius of the cam give a slight rotation to the sector carrying the index point. This motion adjusts the index point automatically for all readings to correct error of the lead screw for each reading, and it is not necessary, therefore, to add or subtract any quantity to make this correction.

For measurement of the pitch of internal threads, Fig. 2, the tail stock carrying one of the centers at the left of the machine is removed and a support substituted having a faceplate on which the thread ring gage to be tested is mounted. Another anvil is substituted on the amplifier device and is mounted on an arm that can be extended inside the ring gage so that it passes over the flanks of the threads in the same manner as in external thread measurements.

The measurements are carried out in the same way as before, except that it is necessary to move the micrometer slide from the left to the right instead of the reverse, so that the anvil may pass over the thread flanks without jerkiness.

For the success of the internal measurements, it is necessary that

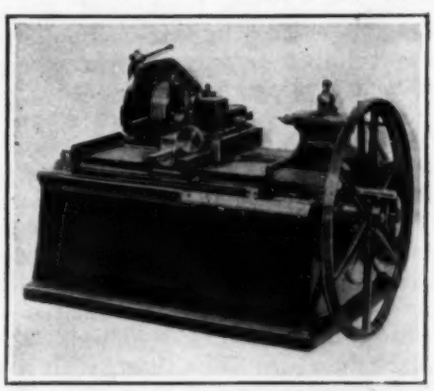

Fig. 2—Pitch-Measuring Machine for internal threads

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the end face of the ring thread gage being tested be absolutely perpendicular to the axis of the thread. Otherwise the pitch will appear to be finer or coarser than the true pitch. This lack of perpendicularity of the end of the gage to its axis may be detected by turning the gage through 180 deg. on the faceplate and taking a second set of readings. The mean of four sets of readings, taken at 90-deg. intervals about the inside of the ring, would give a close approximation to the actual pitch.

Procunier High-Speed Tapping Attachment

The high-speed tapping attachment shown in the accompanying illustration was recently placed on the market by William L. Procunier, 18 S. Clinton St., Chicago, Ill. The device is made in one size and will drive ¼-in. taps in steel and ⅜-in. in cast iron or brass.

The construction of the attachment can be seen in the cross-

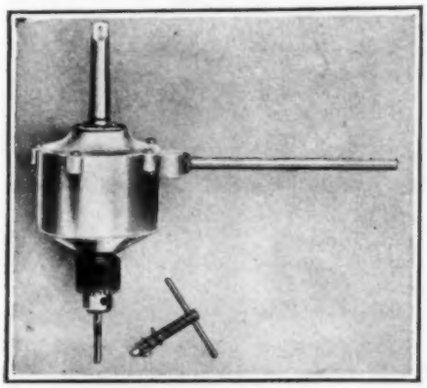


Fig. 1—Procunier High-Speed Tapping Attachment

sectional view, Fig. 2. An aluminum housing, consisting of a cover and a body, is held in position by five screws equally spaced. A Morse taper shank is threaded to fit in the drive shell, which in turn is threaded in the lower end to receive an internal gear. This gear meshes with three intermediate spur gears held in position on shoulder studs, equally spaced. These intermediate gears engage with the reverse gear, which is secured to the reverse shell by four pins.

The chuck is fastened to the spindle by threads, and the spindle in turn is secured to the fiber cone clutch by means of a drive pin held

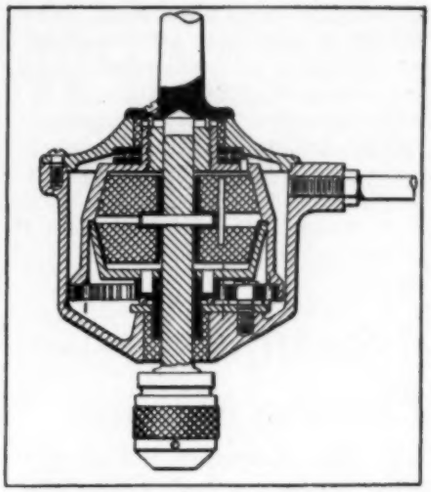


Fig. 2—Cross-sectional view of the device

in position by a lock pin. The neck of the upper drive shell and the reverse gear are incased in phosphor-bronze bushings.

The upper thrust is taken by a ball thrust bearing as is the lower thrust. The lower balls roll on a steel plate which has three projections to support the shoulder studs.

When tapping, the surface of the upper half of the fiber cone clutch is engaged with the conical surface of the drive shell, as shown in Fig 2. The thrust is then taken directly on the drill press spindle and the tap is driven forward. When the tap is reversed the drill press spindle is raised about 1/32 in. This movement disengages the upper half of the cone clutch from the drive shell and engages the lower half with the conical surface of the reverse shell, which now rotates in the opposite direction at twice the tapping speed. Pressure is applied on the gears only when reversing the taps. It is said that bottom or blind tapping may be accomplished as easy as through tapping, since the power may be regulated by the amount of pressure applied on the press spindle by the operator.

"Stable-Arc" Welding Rod

The Lincoln Electric Co., Cleveland, Ohio, is marketing a line of high-grade "dipped" welding rods under the trade name "Stable-Arc" as a companion product for the "Kathode" welding rod, also made by this company. The Stable-Arc welding rod is obtainable in standard 50-lb. bundles wrapped in burlap and in lengths of 14 in. It can be secured in longer lengths, if desired, and in any diameter up to ½ in., an unusual size for which the rod is particularly designed.

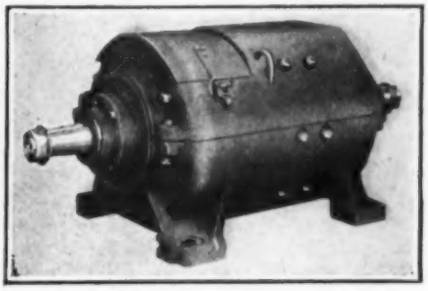
It is claimed that this rod permits of much higher current than has been used heretofore, with resulting greater speed and hence a lower labor cost in welding. Current densities of 15,000 amp. and more per sq.in. can be used. It is said that this greater heat gives not only greater speed at less cost but also better penetration and a much smoother finish to the bead. The greater heat also results in an annealing action, which increases the ductility of the weld and gives a greater elongation.

The claimed decrease in the "splutter" of the arc gives less spattered metal and therefore more actual metal is deposited per pound of rod. The higher current, it is claimed, gives a remarkably clean finished weld on heavy welds of more than one layer so that very little brushing or cleaning is necessary between beads.

General Electric MD-400 Series Steel-Mill Motors

The General Electric Co., Schenectady, N. Y., has designed a line of steel-mill motors known as the MD-400 series in collaboration with the standards committee of the Association of Iron & Steel Engineers. These motors are said to be the first to meet fully the specifications of that body.

Roller bearings are supplied as standard although sleeve bearings can be furnished at the option of the purchaser. The line involves improved mechanical construction, more efficient use of materials and a refinement of details, when compared



Typical General Electric MD-400 Series Steel-Mill Motor

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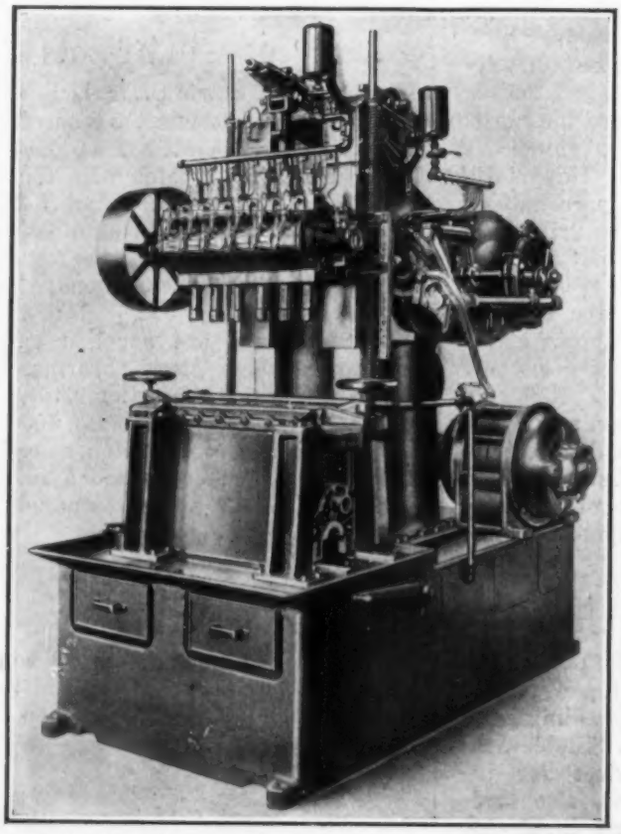
with the superseded line of MD-100 motors. A greater adaptability to severe service conditions is also claimed. Parts are more accessible and, at the same time, are better protected. Bearing construction for either sleeve or roller bearings incorporates some improvements.

Among the claims made for this line of motors are: Ability to commutate high overloads; ready accessibility of each part; great mechanical strength of individual parts and exceptional security of the whole structure; ability to accelerate rapidly and to withstand frequent reversals; and heat resisting insulation composed of mica and asbestos conforming to the A.I.E.E. Class B insulation specifications.

"Hole Hog" Improved No. 10 Multiple Spindle Automatic Lapping Machine

THE Moline Tool Co., Moline, Ill., has added some improvements to its No. 10 multiple-spindle automatic lapping machine, described on page 928, Vol. 65, of the *American Machinist*. The original design required two clutches: one on the main driveshaft through which the rotation of the spindles was controlled, and another on the main driving gear through which the reciprocation could be controlled independent of the rotation.

In the improved design shown in the illustration both of these clutches have been eliminated and in their place one large twin-disk clutch has been substituted. It is mounted on the drive pulley of the main shaft and by it the entire machine can be started and stopped at will. The clutch is actuated through the center of the main drive shaft by a plunger acting through the medium of a spool and shifter as can be seen. On the end of the main drive shaft a large drum brake is mounted. It is operated by the same parts as the driving clutch and gives a positive and sensitive control to the machine, since the brake is applied when the clutch is disengaged. This feature is particularly desirable in stopping the reciprocation of the rail and the rotation of the laps in the withdrawn position. It also is said to eliminate shock in starting the machine. With this improvement, the operator shifts the starting level that engages the driving clutch and releases the brake simultaneously, thus starting the rotation of the laps and bringing them down to the working position where they reciprocate a predetermined number of strokes, after which they return to the starting position and instantly stop rotating and reciprocating.

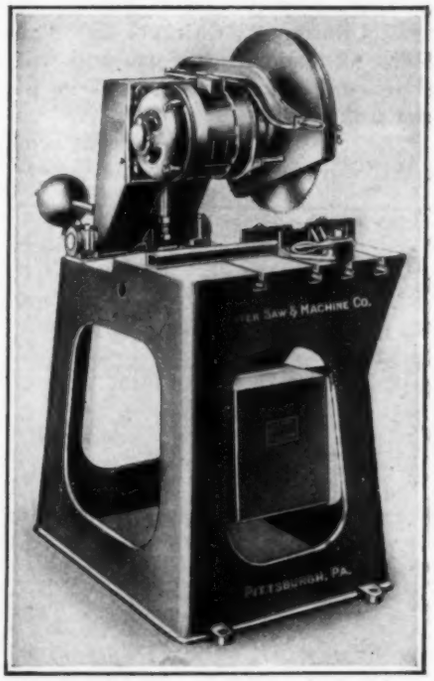


"Hole Hog" Improved No. 10 Multiple-Spindle Automatic Lapping Machine

Hunter No. 0 High-Speed Metal Cut-Off Saw

The No. 0 high-speed metal cut-off saw has been designed by the Hunter Saw & Machine Co., Pittsburgh, Pa., to cut cold metals such as the smaller light-section beams and angles; brass, copper, structural and welded tubing; pipe; fence and fire escape materials; metal mouldings; metal furniture parts; light-section pressed- and drawn-steel shapes and the like. It is claimed that, due to the high rotative speed of the circular, inserted-tooth saw, cuts can be made in a very short time.

The saw blade is mounted directly on the motor shaft, rotating at 3,500 r.p.m. and giving a peripheral speed of 16,500 ft. per min. The motor is rated at 5 hp. and can be furnished for 50 or 60 cycles, two or three phase, and for 220, 440 or 550 volts. The armature is mounted on ball bearings held in dust-proof housings.



Hunter No. 0 High-Speed Metal Cut-Off Saw

The saw blade is fully protected by steel guards to conform with safety specifications. It can be easily removed to change saws, however. A pocket is cast on the under side of the table inclosing the saw at its lowest point to catch the cuttings, which can be removed through

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a door at the bottom of the pocket.

The tilting frame has a spring cushion stop and is connected with a spiral spring to return the frame to the height necessary to clear the material being cut. The saw is fed down by an off-side hand lever attached to the tilting frame and a stop is provided so the saw will just cut through the material. The motor saw and frames are counterbalanced by an adjustable weight.

The table is provided with a quadrant stop that can be set to any angle within the sweep of the saw blade used. It is held firmly in position on the table by a bolt moving through T-slots. The material can be clamped by a quick-acting eccentric vise.

The machine occupies a floor space of 23x37 in. and has an over-all height of 55 in., while the table is 31 in. from the floor. The machine weighs 900 lb. net. Regular equipment includes a starting switch for the motor, necessary wrenches and two saws.

SPECIFICATIONS

Maximum Cutting Capacity

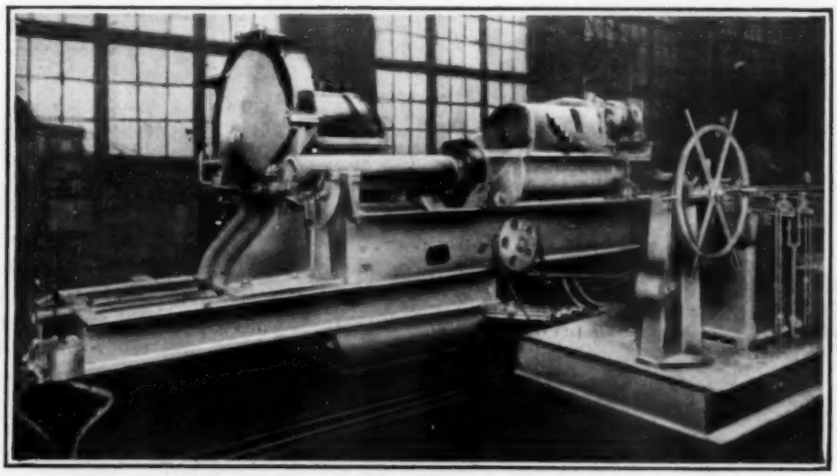
Section	Size, in.	Time, sec.
Standard pipe.....	3	2
Angle	2x2x¼	3
Solid steel bars....	3	3
Brass, solid	3	2
Brass tubing.....	1½	3
Copper tubing.....	1½	3
Conduit tubing....	3	2
Standard tubing...	2	3

Rotary Attachment for Ryerson Friction Saws

JOSEPH T. Ryerson & Son, Inc., Chicago, Ill., has developed a rotary attachment for use with either the No. 3 or the No. 4 Ryerson high-speed friction saws, so that large rounds, squares, pipe and the like, can be cut to the short lengths in a minimum of time. For example, it is claimed that with the No. 3 saw and this attachment, an 8-in. standard pipe can be cut without distortion in about 12 seconds.

The attachment consists of a structural framework upon which the carriage for holding the material travels. A pneumatically-operated chuck grips one end of the stock, and it is rotated by means of a constant-speed motor through a change-gear box located on the carriage. Power lines for the motor are located in a protected position on the frame. A center rest mounted on the worktable of the saw is arranged to receive bushings for various sizes of material. A sliding gage stop is also located on the worktable and consists of a heavy casting with a screw stop for fine adjustment. Between the steady rest and gage stop is a V-shaped support that holds the work while it is being cut and also acts as a dumping device for the finished pieces. It is connected to a pneumatic cylinder and operates from the control stand.

The central control stand, shown in the illustration located at the right front of the saw, enables one operator to control all production operations from this position. Levers for controlling the saw and cooling water for the blade, air valves for operating the pneumatic chuck, and a capstan wheel for moving the material forward to the next cut are all located here. Controls for starting the motors can also be placed on the stand, if desired.



Rotary Attachment for Ryerson High-Speed Friction Saw

"Adamant" Gun

The Botfield Refractories Co., Swanson & Clymer Sts., Philadelphia, Pa., has developed the "Adamant" gun, shown in the illustration, for use in facing or coating the fire-exposed surfaces of new or old furnace linings with Adamant firebrick cement premixed with "Adachrome" or other refractory material. The gun can also be used for filling in depressions or burned-out sections of brickwork, thus giving the structure a uniform, even surface. It is claimed that the entire brickwork of an average boiler can be resurfaced in less than an hour and

"Adamant" Gun

that 100 lb. of the premixture will surface a wall area of 100 sq.ft. with a coating approximately ½ in. thick.

The gun operates on either air or steam pressure ranging from 50 to 80 lb. per sq.in. Air is said to give more satisfactory results and is therefore recommended. Lesser or greater pressures can be employed,

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depending upon the consistency of the premixture being handled and on the distance from the work at which the gun is used. The air or steam line is coupled to the ½-in. standard pipe thread opening on the globe valve. There are no moving parts to get out of order, and there are only two wearing parts, the forcing nozzle and the outside nozzle. Both are made of tough wear-resisting material that is said to last indefinitely.

The gun stands 18½ in. high by 10 in. wide, and can easily be operated by one man. The handle is of wood, shaped for comfort, and is conveniently positioned so that the operator can direct the mixture at any angle. The force of the stream is always under his control through the regulating wheel on the globe valve. The gun is designed to lay the mixture on the wall, and freedom from spattering is claimed. Clogging is said to be impossible, due to the presence of a vent pipe, which can be seen at the right of the lower supply pipe in the illustration. The supply pipe is cut away at one side to permit easy entrance of the mixture.

The refractory material used should pass a No. 10 mesh or finer. The gun is so constructed that it will lift and blow to the surface all materials passing this mesh, including the finest particles as well as the coarser aggregate without separation. It is recommended that this gun be used with Adachrome, a chemically-neutral material, the base of which is chromite. When this material is mixed with the proper proportion of Adamant cement as a binder and applied on the furnace walls with the Adamant gun it is said to form a refractory coating which is highly resistant to both basic and acid slags, fusible coal ash and other corrosive or destructive elements.

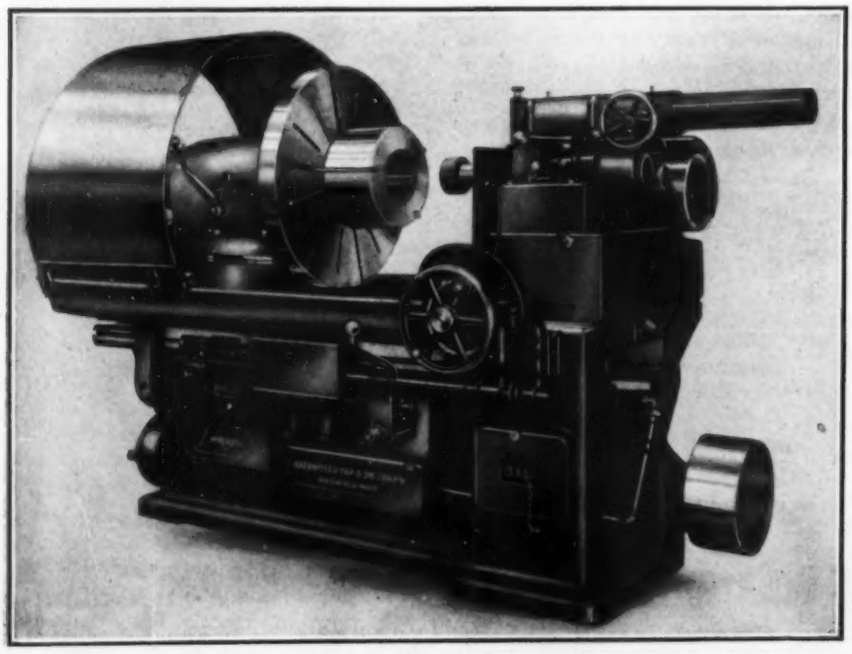
Greenfield Heavy-Duty "Hydroil" No. 28-C Internal Grinder

THE Greenfield Tap & Die Corporation, Greenfield, Mass., has added the No. 28-C machine illustrated to its line of heavy duty "Hydroil" grinders. The No. 28-B machine was described on page 560, Vol. 66, of the *American Machinist*. The No. 28-C machine swing works 48 in. in diam. and will grind a hole 32 in. in diam., using a wheel 10 in. in diam. The depth of the hole ground is governed to some extent by the holding fixture and the length of the wheelspindle. The normal table travel is 42 inches.

The workhead is of the heavy-duty type and is operated by a belt from a drum in the base to a jackshaft, and thence by silent chain to the work spindle. The head is mounted on ball bearings throughout of extra large size to withstand the heavy loads developed at the wheel due to the application of 20 horsepower.

The work table is reciprocated hydraulically by oil pressure as in previous models, and all controls are centrally located. Ample protection from flying grit and water is furnished the machine through the overhanging splash guard and the guard around the wheelhead. A large reinforced sheet-steel water guard is mounted on rolls and can be instantly run forward over the work when the machine is in operation, thus completely protecting the operator. It can be easily pushed out of the way when handling pieces by chain falls or cranes.

The entire machine is run by a single motor that drives a shaft on the back of the base from which all moving parts are operated. The drive may be of two types: Either direct belt connected to motor or chain connected to a motor mounted on a bracket. The latter is the most compact type of drive.



Greenfield Heavy-Duty "Hydroil" No. 28-C Internal Grinder

Garvin No. 2-X Vertical Automatic Tapping Machine

The Western Machine Tool Works, Holland, Mich., have made a number of improvements in the line of Garvin tapping machines, which they recently took over. In the illustration is shown the No. 2-X machine equipped with Timken tapered roller bearings and integral motor drive, in connection with a special speed reducer which is so designed that the input shaft can be placed at any height to suit the base-to-center height of the motor. It can also be belt driven.

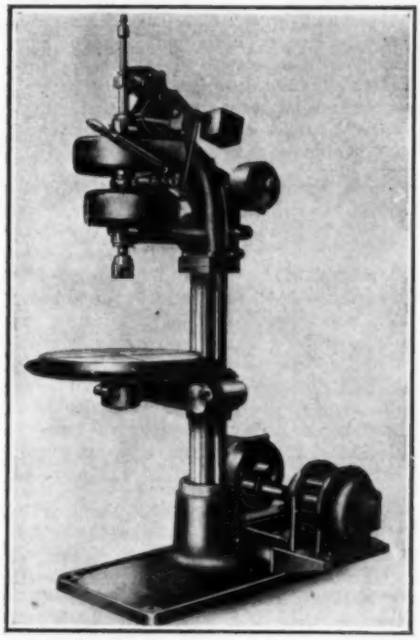
The head is a separate unit from the column and is bolted thereto. Special duplex columns can be provided so that the two heads can be bolted to the column, thus doubling the capacity of the machine.

The head is automatic in operation in that the operator simply pulls down the hand lever or steps on a treadle until the tap enters the work. From there on, the action is auto-

Shop Equipment News

matic; the tap enters to a predetermined depth, then reverses and stops. The spindle is so arranged and balanced that it will not cramp and will therefore withdraw the tap without stripping the last thread. The machine is said to produce taps on a production basis and to cut neat, fast threads without tap breakage.

The head is completely mounted on Timken tapered roller bearings. The spindle is fitted with two friction pulleys driven in opposite directions by one continuous belt. Between these pulleys is a double-faced friction clutch keyed to the spindle. The clutch is connected with a hand lever by a mechanism which is adjustable



Garvin No. 2-X Vertical Automatic Tapping Machine

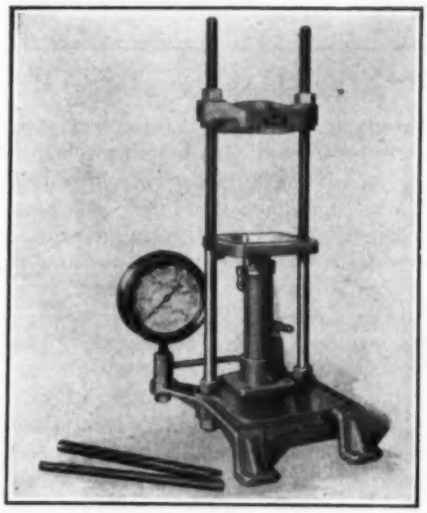
to any desired tension. The pulleys are mounted on the roller bearings in such a way that cocking is avoided and by the same construction the spindle is supported in a long stationary bronze sleeve.

Table improvements include deep oil channels and large drains into oil reservoirs. The table has T-slots planed out of the solid for proper clamping and is mounted on an arm that is adjustable by a rack and pinion. It can be locked in any desired position. It can also be swung around the column.

The machine will handle U. S. Standard taps in cast iron ranging from ¼ to ⅞ in., and in steel from ¼ to ¾ in. It will tap a hole up to 2½ in. in depth. The motor is rated at 2 hp. at 1,800 r.p.m. The machine occupies a floor space of 31x45 in. and its net weight is 1,050 pounds.

Carver Laboratory Hydraulic Press

The laboratory hydraulic press shown in the illustration was recently placed on the market by Fred S. Carver, 90 West St., New York, N. Y. It was developed for various



Carver Laboratory Hydraulic Press

kinds of tests on a small scale. It will determine and check pressure and operating conditions for production on large presses. It can also be used for crushing tests, plastic molding, briquetting, embossing, drawing and forming operations, testing springs, and numerous other applications.

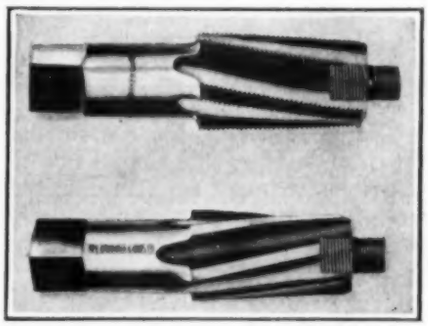
Hydraulic pressure is supplied through a small hand-operated pump and pressure on the platens up to 10 tons can be obtained. The platen measures 6 x 6 in., and the opening is adjustable from 0 to 16 in., with 7½ in. between columns. The platen has a drainage groove and drain for use when pressing out liquids. The opening between platens may be quickly adjusted by hand, and they may be closed flush, if desired. The press is equipped with a large accurate gage, which is direct reading and shows both the total load as well as the hydraulic pressure.

The press occupies a space of 16½ x 15½ in., and is 36 in. high. Its weight is 115 pounds.

Brubaker Flexible Staybolt Tap and Reamer with Removable Pilot Screws

The W. L. Brubaker & Bros. Co., 50 Church St., New York, N. Y., is marketing a line of flexible staybolt taps and reamers with removable pilot screws, as shown in the illustration. In place of making the pilot screw a solid part of the tool these taps and reamers are made with a U. S. Standard threaded hole in which is inserted an unhardened adaptor stud with its outer end threaded with a standard pipe thread for use with the usual extension.

Several advantages are claimed for this design: The unhardened pilot screws are not brittle and consequently are less liable to break than those tempered with the tool; in case of breakage and stripping of threads



Brubaker Flexible Staybolt Tap and Reamer with Removable Pilot Screws

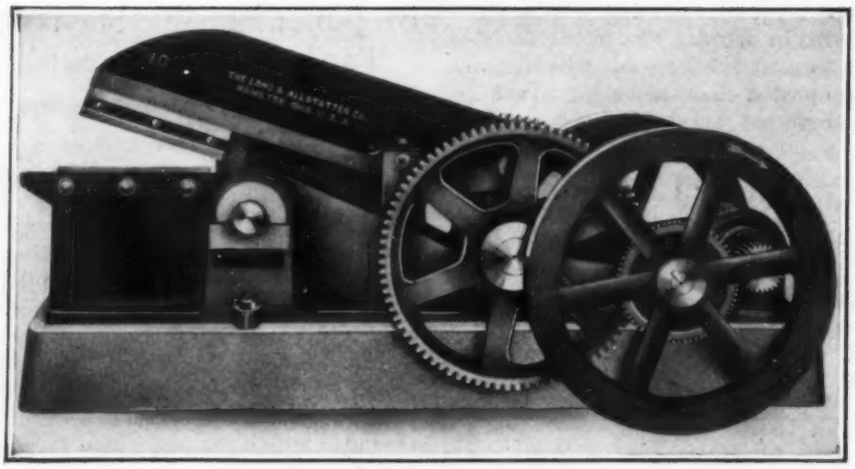
of the stud, the adaptor is quickly removed and a new one inserted which prolongs the tool's use; the same tools may be used with an extension having either an inside or an outside thread.

Long & Allstatter Lever Shear

The Long & Allstatter Co., Hamilton, Ohio, has built the lever shear shown in the illustration, of all-steel construction except the flywheels, bearings and tapered liner. The machine incorporates an easily-replaceable safety shearing pin that insures the main machine parts against breakage in case a piece larger than the capacity of the machine is inserted between the blades.

In order to balance the driving

Shop Equipment News



Long & Allstatter Lever Shear

load, twin gears are mounted on the heavy steel crankshaft. These gears are machine cut from steel, so that the load is distributed evenly over them. The gear bearings are bronze-bushed so that they can be easily replaced when worn.

The main lever bearing is also bronze-bushed and the side thrust developed when shearing is taken by a tapered adjustable gib. With this provision, all lost side motion can be taken up without resorting to the use of shims.

Federal Electric "Triple-A" Siren

The Federal Electric Co., 8700 South State St., Chicago, Ill., announces the "Triple-A" siren for use as a fire alarm in industrial plants, factories, mines and warehouses. It can also serve as a start-and-quit work signal in such plants.

The device consists of three sirens mounted on a triangular base. They are connected in parallel and operate from one push-button switch. Each siren is driven by a motor of approximately ½ hp. The tone of each is different and has been so selected as to give a pleasing combination. With one horn mounted on each angle of the base the sound under normal conditions has a radius of ¾ to ½ mile in every direction.

The device is simple in construction and is entirely inclosed. The exposed parts will not rust or corrode. The motor housings, stators and rotors are die-cast from high-grade aluminum, while the horns and weather housings over the motor cases are spun seamless tubing. The entire outfit is finished in red Duco and weighs about 40 pounds.

Federal Electric "Triple-A" Siren

Trade Catalogs

Furnaces, Electric. The Automatic & Electric Furnaces, Ltd., 173 Farringdon Road, London, E. C. 1, England, recently issued an illustrated leaflet describing its Wild-Barfield electric furnaces. Several typical installations for use in hardening tools and small parts are shown.

Industrial Lighting. The Cooper Hewitt Electric Co., Hoboken, N. J. has published catalog No. 500 entitled "Cooper Hewitt Work-Light for Industrial Lighting." This publication contains eighteen 8½x11-in. pages and is attractively illustrated throughout. The advantages of this type of light are first cited, the characteristics noted, and several typical installations described and illustrated. Considerable useful engineering information on illumination is included.

Steel Castings. The Lebanon Steel Foundry, Lebanon, Pa., has issued the fifteenth of a series of bulletins on steel castings. In this bulletin the work that goes on in the cleaning department is described and illustrated by several photographs. The operations include sand blasting, the removal of feeders and gates, chipping and grinding, welding, heat-treatment, final finishing, straightening, and final inspection.

Temperature Control Apparatus. The Brown Instrument Co., Wayne and Windrim Aves., Philadelphia, Pa., has issued an illustrated leaflet showing that temperatures control apparatus is equivalent to hiring a man for 14 cents a day. An installation in a typical plant is described at length.

Tools. The Bicknell-Thomas Co., Greenfield, Mass., recently published its Catalog No. 12 describing tools of the Christy "XTY" design. This line includes standard counterbore cutters and holders, flue sheet tools, core drills, back spot facers, and the various parts that go with these tools. A counterbore grinding fixture is also illustrated and space is given to a thread lead indicator. The catalog contains twenty-four 6x9-in. pages and is attractively illustrated throughout. A table of recommended cutters for standard hexagon nuts and a table of rivet and screw head dimensions are also included.

Tools, Small. The Whitman Barnes-Detroit Corporation, 2056 West Fort St., Detroit, Mich., has issued its catalog No. 93. This publication contains 176 pages, 5¼x7½ in., and is completely indexed as well as thumb tabbed for quick reference. Besides the index, the book is divided into seven parts: Hercules drills, miscellaneous drills, millimeter drills, reamers, cutters and end-mills, counterbores and miscellaneous small tools. Each particular item is illustrated by means of a photograph. Useful engineering tables are included.

Transmission, Variable-Speed. The Reeves Pulley Co., Columbus, Ind., has available for distribution a reprint of an article that appeared in the February 1927 issue of *Factory* entitled "Getting the 'One Best Speed' for each Machine Load," by Reginald Trautschold. This article tends to prove how the variable-speed transmission solves a production problem common to many industries.

Pamphlets Received

Chrome-Nickel Steel. The International Nickel Co., 67 Wall St., New York, N. Y., has published bulletin No. 10 of a series on nickel steel, entitled "Chrome-Nickel Steel in Special Track Work." This publication contains eight 8½x11-in. pages, wire bound but punched for insertion in a loose-leaf binder. The text is an abstract from a paper read by F. G. Hibbard of the Milwaukee Electric Railway & Light Co. before the Technical League of that organization. The wearing qualities of this class of steel for this type of work are brought out. Experience in welding is also cited.

NEWS OF THE WEEK

Manufacturing and Financial Economy Aid Return of German Machine Trade

Recovery of export markets is slow and tedious

By Our Berlin Correspondent

THE recovery of Germany's machinery export after the sharp relapse following the Mark stabilization is a slow and tedious process. A certain progress can be noted in the returns of 1926, but it kept within modest dimensions. The strong upward movement which carried the machinery export from 271,000 tons in 1924, the lowest on record, to 369,095 tons in 1925, was not repeated in 1926. The total in that year amounted to only 396,034 tons, compared with 491,000 tons in 1922, and 509,000 tons in 1913.

A better picture is furnished by the value figures. In 1926 the machinery export had a value of 716 million M as against 610 million M in 1913. This rise in value cannot entirely be explained by the higher level of prices, unless it were assumed that German manufacturers obtained better prices for export than in the home market. The ratio between present and pre-war prices is approximately 10:13, whereas the value of exported machinery has risen by 60 per cent per ton. The reason for this divergence is to be found in the fact that the export of low-priced standard machinery has suffered more in proportion than that of quality products. This is not surprising, seeing that Eastern Europe, which used to be the best market for such machinery has lost a good deal of absorptive power and in view of the fact that a number of young countries, which Germany had prior to the war supplied with such machinery have developed industries of their own.

In the following table is seen the export returns of the main groups and classes of machinery in 1926, in comparison with the two preceding years and with 1913.

There are very few classes of machinery which in 1926 had an export equal to that of 1913, or exceeding it. Such exceptions are embroidering and knitting machines, cotton spring machines and cotton mills. In all other cases the export remained more or less below that of 1913. The most striking examples are machinery for the sugar industry, of which only one seventh part of the 1913 volume was exported in 1926; hoisting machinery, ore dressing machines and locomotives. The higher standard of prices somewhat levels the drop in a number of instances but not in all. Only in the case of highly developed machinery, embodying more work than material, are the value figures overlapping those of 1913, in spite of lower tonnage. For instance the value of textile machinery exported in 1926, including sewing, embroidery, knitting machines and the like, was 151 million M, and the tonnage 57,213,000 tons. The corresponding figures of 1913 were 101 million M, and 68,449,000 tons. A similar discrepancy is apparent in the case of metal working machine tools, pumps, book-binding machinery and printing presses.

	Metric Tons				Values Million Marks			
	1926	1925	1924	1913	1926	1925	1924	1913
Steam locomotives and traction engines	27,017	32,957	24,048	77,911	41.4	41.6	29.3	77.7
Power generating machinery (including electrical machines)	46,192	41,224	25,378	65,261	83.4	73.1	40.3	111.4
Textile machinery	57,213	58,630	48,630	58,449	151.6	140	104.7	101.2
Agricultural machinery	48,623	42,097	23,498	63,770	46.4	40.7	23.8	51.2
Cranes	8,916	5,488	2,828	9,222	9.5	5.7	2.6	7.5
Pumps, including fire engines	10,365	10,898	8,078	15,170	21.9	19.5	14.1	19.1
Metal working machine tools	60,621	45,183	34,038	74,336	93.7	77.4	53.4	81.8
Wood working machinery	9,229	10,323	9,658	12,222	13.4	15.2	12.9	12.4
Machinery for grain mills	5,872	6,408	5,696	13,944	10.5	10.6	8.1	15.6
Wood pulp and paper machinery	7,829	7,442	4,413	10,668	9.5	8.5	4.8	9
Hoisting machinery	6,873	6,957	7,561	14,586	10.4	9.7	11.1	12 5
Bookbinding	5,328	6,025	4,802	6,221	16.6	17.2	13.1	11.8
Ore dressing machinery	4,744	4,248	2,574	13,705	4.9	4.2	2.7	9.6
Ventilating machinery	3,052	3,234	2,146	5,566	12.6	10.7	6.7	8.6
Shoe and leather machinery	4,328	4,710	3,647	4,067	10.2	11.2	8.3	8.3
Machines for the ceramic industry	7,181	7,338	6,016	18,909	7.8	7.5	5.8	14.4
Printing presses	10,872	12,301	9,063	12,209	30.9	34.5	24	22.2
Machinery for the sugar industry	2,451	3,609	2,878	17,283	2.7	2.8	3.3	12.3

For many decades German machinery builders regarded the whole world as their export market. They had to shift ground in post-war years. Having lost a great part of their export business to eastern and southern Europe, they were naturally looking for compensation in other countries. Broadly speaking, the trend of German expansion has a direction toward the West. German industry has tried hard to reopen the closed door to Russia, but with very little success. Little has been realized of the potentialities, which are seen in the Russian market, and although a certain progress is noticeable in that direction it has been achieved with a good deal of effort and considerable sacrifice. The 33,371 tons of machinery which were exported to Russia in 1926 constitute barely a third part of the export of 1913. Notable quantities can be detected in the export list only of spinning machines, machinery for cotton mills, machine tools, and agricultural machinery, including mowers, threshing machines and harvesters.

German comments on the machinery export in 1926 voiced disappointment, especially in view of the efforts made toward expansion. The chief obstacles toward recovery of the export business of 1913, which seems to be the German machine building industries' goal for the present, are seen in the low purchasing power of eastern Europe, the prohibitive customs legislation in many countries who used to be Germany's best customers, the existing aversion against trading with Germany, as a residue of the war spirit, and the lack of efficient foreign sales organizations. In the latter respect much has been done during the last year, and upon this fact German hopes are built. In conjunction with the indisputable progress German manufacturers have made in the direction of economic quantity production and the growing financial strength of industry, the future of the German machinery export is viewed with a good deal of confidence.

Cuba Offers a Growing Market for American Machine Tools

Railways, power plants and sugar mills are users

By Staff Correspondent

IT IS far from easy to write about conditions in Cuba from the machinery point of view. Each man you meet has a different opinion, based upon the individual experience which gives him a special viewpoint. One of the largest machine dealers on the island reports business for 1926 at less than half that for 1925. Machine tools totaled about $200,000 of his total business last year. Another dealer who has been in Cuba for more than 25 years reports 1926 the worst year he has ever known.

On the other hand, several of the newer dealers report business is increasing, and seem optimistic for even the immediate future. Not having enjoyed the boom during the days of high sugar prices, they have no background of inflated values to disturb their present outlook, and can, perhaps, judge of conditions more correctly on that account. Small shop owners, too, seem to be quite busy in their particular lines, which are, of course, widely varied and are largely connected with repair or maintenance of machinery of some kind.

Railroads and Sugar Mills

Railroads and sugar mills are the main industries employing machinery, and their upkeep is the principal field for machine tools and machine supplies. With the railroads should be counted the electric street railways and some of the suburban rail lines. Closely allied with them are the power plants for both electric railway and for light and power uses. Aside from small shoe manufacturing shops, this seems to cover the machine industries, unless we count the cigar factories, whose machine equipment is practically all imported.

Each sugar mill, or "central," has its repair shop, but judging from those visited, and from reports, the great percentage of repairs is done by shops that specialize in this work, even where this involves shipping rolls and other parts a considerable distance. Perhaps the best known shops of this kind are the Havana Marine and Drydock Co., the Vida de Ruiz de Gamiz plants at Casa Blanca, across the harbor from Havana, the Fundicion Union de Sagua, S. A., of Sagua Le Grande, and the shop of Pedro H. Etchegoyen y Hijos, of Cardenas. The usual plan is to have the sugar mill machinery overhauled during the summer, during the non-grinding season, so that only emergency repairs need be made while the grinding is on. Preparation for the busy season includes the making of extra rolls and other parts to have them ready in case of breakdowns. But even with this precaution, the unexpected happens, and rolls and their shafts have a way of giving out in the midst of grinding. Even in this case, however, the shops that specialize in this work seem to get most of it, and I saw very little being done in the shops of the "Centrals" that I visited.

The railways, both steam and electric, require a constant supply of car brasses and similar parts, not to mention power plant repairs in the case of the latter. These parts are frequently purchased from local shops, one such shop turning out a goodly number with a minimum of equipment. Most of the machinery comes from the United States, and some of the well-known brands of bearing metal seem to be firmly established.

Oil Use Uncertain

Power plants are practically all steam-driven with boilers fired either by coal or oil. There seems to be a halt in the growth of the use of oil, due to the uncertainty as to its future price. At present it is said to be about as expensive as coal and there is indecision as to the future. The railroads use oil in their locomotives. There are also some Diesel and semi-Diesel engines in use, but largely as auxiliary power. This means power for lighting or small power uses in the dull season as no sugar mills, so far as learned, are yet driven by oil engines. Some of the newer powerhouses for railways, lighting and local power are using internal combustion engines, mostly as auxiliaries at present. The use of oil engines in these plants seems destined to grow, however. But as the syndicate that has taken over practically all the electrical power supply of the island has invested heavily in so doing, it is probable that expenditures for new equipment will not be largely increased in the near future.

Most power plants have at least some turbine equipment and future expansion in power units will probably lie between the turbine and the Diesel type engine. There is a growing need for electric power, the newer sugar mills using electric motors on the crushing rolls instead of being coupled, through heavy gear trains, to slow-moving engines of the Corliss type. This changes the appearance of the mills in much the same way as the turbine has changed the complexion of the modern engine room.

In spite of reports of large sums spent for machine tool equipment, I was not fortunate enough to locate much of it outside of the railway shops. Reports of new equipment came to me from various sources, but not much was in evidence in visiting some of the shops suggested as being the "best in Cuba." Information located the new machines in different shops, and it is quite possible that some of the list were missed in following various suggestions. This does not mean that no good equipment was discovered—only that the amount of new machinery was less than I had expected to find.

Most business men expressed the belief that there would be more money available after the sugar crop than for several years. The price of sugar is higher owing to the restrictions as to grinding that were placed by the Government this year. Each mill has its allotment of a given number of thousand bags of sugar, the bags holding 325 lb. each. When the allotted number is reached, the mill shuts down until next season.

Opinions vary as to the ultimate effect of the restriction. A banker doubted its efficacy and predicted great hardship among those who depend on the sugar mills for employment. It was his belief that the interference with the law of supply and demand would be disastrous. Other business men seem to feel that it may work out for the best interest of the island. Nearly all seem hopeful of better business as a result of the present sugar crop. This probably means the paying of present indebtedness and the placing of new orders for the future.

According to one dealer in machinery, the United States is greatly handicapped in the matter of prices on machine tools. Our present prices, which are certainly none too high considering costs, are being greatly underbid by machines from other countries. One case was reported where a copy of an American lathe, from Denmark this time, was quoted at less than half the U. S. price of the original. Other instances were also cited, all at substantial reductions on the United States prices. In spite of this, however, there is evidently enough preference for United States machines to make them much in evidence in every shop visited. Whether this will be true in the future depends more on quality and salesmanship than price.

Whatever present conditions are, however, there is no doubt as to Cuba being a growing market for machinery. That a goodly portion of future business will come to the U. S. can hardly be doubted.

Spare Parts Considered Break-Down Insurance

R. M. Hudson, chief of the division of simplified practice of the Department of Commerce, discusses the spare parts problem in a recent bulletin, saying that individuality in sizes and dimensions of wearing parts forces the machinery equipment used either to carry a large stock of spare parts or to wait until he can secure them from the manufacturer. The user may regard his spare-parts inventory as insurance against break-down, but nevertheless the greater the diversity of his equipment, the heavier the cost to him of such insurance.

In emergencies the equipment manufacturer cannot always be depended on for quick delivery. To obviate this difficulty, the user makes his own repairs with his own facilities or with the help of a local job shop.

This procedure results in a diversion of parts business from the manufacturer, plus the high cost of manufacturing non-current parts a few at a time. This tends to raise the manufacturer's price to a point where the user is unwilling to pay it and he will try to find a cheaper way, say, by making the repairs himself.

Joint Conference Studies Methods of Avoiding Manufacturing Wastes

Managers and engineers compare notes

A JOINT co-operative conference on the subject "Controlling Avoidable Manufacturing Expenditures," was held by the production executives' division of the American Management Association, the Management Division of the A.S.M.E., and the Detroit Section of the S.A.E., at the Book-Cadillac Hotel, Detroit, April 27, 28 and 29. The papers dealt with control of manufacturing from various angles such as production, purchase, quality, work in process, training workers, changing products and varying output. The presiding officers at the eight sessions were W. R. Clark, general works manager, Bridgeport Brass Co.; W. B. Minch, works manager, Jaxon Steel Products Division, General Motors Corporation; Merit R. Lum, vice-president, A. W. Shaw Co.; W. W. Nichols, vice-president, D. P. Brown & Co.; A. J. Brandt, vice-president, Oakland Motor Car Co., and W. J. Rhodes, works manager, Carter's Ink Co.

Oscar Groethe, vice-president of the White Sewing Machine Co., outlined that company's practice in controlling manufacturing expenditures, telling how consolidation of plants had saved 350,000 sq.ft. of floor space. Single purpose machines, while giving a slightly lower labor cost, were not found flexible enough when change had to be made in the design of product, and he advocated standard machines with special tools and fixtures where needed. Another important factor in costs is to use as many similar standard parts as possible in various products.

Savings can be made by showing each department head the cost of such supplies as files, reamers, drills, etc., in dollars per week or month. In fact all "burden" should be shown in dollars instead of percentages, as it means more to the men. Consolidating departments saves money in the keeping of records and in floor space.

The men in the White Co. do not use a time clock, the supervisory force does. As production is what counts the foremen are on the job early and get a bonus for the work passed by inspection. Foremen are not bosses, but helpers in getting out good production. Penalties are never mentioned—only rewards for bettering standard production times. Each department is budgeted in detail as to materials, tools, etc. One man studies conditions and reports to the works manager and a daily check is made on production and purchases. Layouts are checked both by engineers and non-engineers, who frequently simplify methods. Inspection checks scrap daily and has reduced it in some cases 60 per cent.

Carl J. Sherer, treasurer, the Marmon Motor Car Co., told how a purchasing schedule had abolished storerooms. These purchase schedules are given to vendors with delivery specifications to keep only a safe margin of material on hand. Thin material goes right to the department requiring it. This method, of course, requires a small store of materials at various points in the shop but there is no general storeroom. The amount of material in the plant depends both on the quantity used, and the size lot needed to make an economical shipment.

"Stores Control of Raw Material" was discussed by J. E. Padgett, of the Spicer Manufacturing Co., while L. I. Shaw, of the Western Electric Co., spoke on "Quality Inspection of Materials."

Charles S. Craigmile, assistant general superintendent of the Belden Manufacturing Co., told in considerable detail of a method of planning and controlling process work. Control charts show value in dollars and also process inventory in proportion to direct labor. Material is an important item and no extra material can be secured without a special requisition slip that always demands an investigation as to reasons.

Actual costs in dollars are discussed with foremen, and excess costs are charged against process inventory. Work in process is divided into lots so that any error will be caught very quickly instead of at the end of a long run of work.

H. V. Coes told how his company had monthly dinner-meetings with the foremen and showed both budget and actual figures in dollars and cents. When a foreman is above or below schedule he tells why, or how. This plan makes the foreman keen to keep expenses down and it secures intelligent co-operation.

Planning and controlling work in process was told by J. D. Towne, of the Dayton Steel Foundry Co., which carries practically no stock and depends on orders for more than 3,000 patterns of wheels, etc. A daily follow-up schedule is used that includes both labor-hours and material. The work is budgeted with man and burden-hours for any production. There is a base-burden that is spread over the entire plant.

The discussion on this paper was lively and interesting and included suggestions for the "unit basis" for handling work economically, the unit depending on the work and the character of equipment employed.

W. W. Nichols presented L. P. Alford's paper based on the report of the safety committee of the American Engineering Council on the "Reduction of Costs of Production Through Reduction of Avoidable Accidents." This was followed by a paper on "Production Control in the Perfection Stove Co.," by Chas. G. Rehmer.

At the dinner meeting Frank J. Tone, president of the Carborundum Co., gave his observations on industrial conditions in Russia, in which he told of the real progress that was being made along a number of manufacturing lines. Conditions are, from his point of view, much more advanced and more hopeful than is generally believed. H. V. Coes followed with an interesting talk on "Imagined Production Without Engineering" in which he traced the development of production from its beginning, pointing out that engineering was responsible for the difference in progress between industrial nations such as ours and such non-mechanized countries as India and China.

"Reducing Production Costs Through Training Old and New Workers," by Walter S. Berry, the Scoville Manufacturing Co., was widely discussed. He pointed out the necessity of selecting men and boys to avoid a waste of time in training. Men in the toolroom were trained to handle such mathematics as necessary in their work. Only a small percentage could learn sufficient shop "trig" to lay out work. Of these, however, over half have now advanced to more responsible positions.

Foremen have also been trained in how to teach their men the best ways of handling work and of explaining just how it should be done. The result has been better work and higher efficiency in the shop. Mr. Soby told of the work being done by the Technical School at Flint, Mich., to help men fit themselves for other jobs, and Mr. Donald suggested that education should not stop with the apprentice but go all through the plant, clear up to the executives.

"Controlling Avoidable Manufacturing Expenditures During a Change in Design," by E. E. Vender, pointed out the effect of time in making changes, the amount of material to be scrapped, obsolesence, etc. The quicker the change is made the higher the cost, which may of course pay in profit from the new model. H. G. Perkins, of the Chrysler Corporation, dealt with the "Avoidable Expenses During an Increase or Decrease in Output."

Business Cycles Are Superstitions

The National Metal Trades Association convened in the Hotel Statler, Detroit, on April 26, the meeting including a banquet at which Charles A. Eaton, Virgil Jordan, William J. Donovan, Albert Sobey, C. F. Klivefelter and Col. C. L. H. Ruggles spoke. Col. Ruggles discussed "Industrial Preparedness" and pointed out the necessity of complete co-operation between manufacturers and the Government in time of national stress. Albert Sobey talked on "Foremanship" and the part it plays in modern production.

A general tone of optimism pervaded the whole meeting, the members looking forward to a continuance of prosperity. Virgil Jordan made a striking statement to the effect that "The socalled 'business cycle' is a product of the superstition and fear of economic spooks which is excusable only in a primitive business world. Business cycles are man made, they are not inevitable situations of some fatalistic economic destiny. They are the result merely of stupidity and ignorance, and above all, of a lack of faith in the future."

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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IT OFTEN happens that one dominating event changes the orientation of the public vision. Therefore it is not surprising that the great flood in the Mississippi River should have made people more willing to ponder the implications of other adverse happenings that are less serious. Among them are the financial crisis in Japan, the sharp decline in the price of petroleum that is due to either under-consumption or over-production, the bituminous coal strike as a result of which many thousands of miners are in idleness, and the increase in unemployment that is reported from Chicago and several other important Western cities.

None of these conditions is new. They were all known last week, but they were ignored until people began to appreciate the dimensions of the disaster that has overtaken the Mississippi Valley. With those who have suffered by that disaster the whole nation is acutely sympathetic, but every cloud has a silver lining and there is some consolation in the fact that the overflow will arouse the nation to the need of finding a way to prevent its recurrence.

Each of the other unfavorable happenings mentioned has also its bright side. "Inside" advices from Japan intimate that an organization patterned after our Federal Reserve System is in the making and that the government will take care of the banks until confidence is re-established, and in the oil industry there is already some indication that the low prices are increasing consumption. There is also some reason for satisfaction in the fact that bituminous coal has not advanced since the strike was declared and many are saying that this means fewer strikes in the future.

But the darkness of the foreground has been more impressive than the brightness of the perspective, and on the Stock Exchange there has been a noticeable reversal in speculative sentiment. The sharp decline that has followed should not have been a surprise to those who have read these letters, for in them the logic of such a reaction has been repeatedly pointed out. Just how far it will go or how long it will last no one can say, but the security market has now been going up for nearly ten months and it is not to be expected that such a sustained movement can be liquidated in a few days.

The theory upon which the bears are working is that the purchasing power of the country will be appreciably reduced by the Mississippi flood; that our foreign trade will be restricted by what has happened and is happening in China and Japan; that the result will be an increase in unemployment and a decrease in commercial and industrial profits and that this decrease will be reflected in the prices at which stocks can be sold. This is all true, but if credit continues cheap and abundant the decline will be slow and this is no reason why one should sell on weak markets or be stampeded into precipitate liquidation.

These remarks are particularly applicable to good bonds. That they should "sympathize" with stocks to some extent is natural, but if the interest on them is well assured they will not decline much unless there is a sustained rise in the money market and of this there are no indications at present.

There is, however, no such assurance of stability in the commodity markets, and each of them must be judged on its merits. In grain there has not been much change, but speculation has been killed by government supervision and when the growing crops are harvested they will have to be sold at what the commercial distributors will be willing to pay. That this will be much above the present price level seems doubtful.

Cotton appears to have discounted the flood damage and as manufacturers have sold many of the contracts bought earlier in the season the market is likely to be more two sided until we get nearer to the acreage report that will be issued in July. Sugar has been a shade easier upon the fear that the unsettlement in the Far East would make it necessary for Java to ship part of her crop to Europe.

It is said that new automobiles are not selling quite as rapidly as they did last year and that used machines are almost unsalable. The dry goods market is quieter. Silk is a shade higher. So are wool and woolen goods, and distributive trade is upon the whole quieter. Car loadings and bank clearings each reflect the quietude. They are both slightly under last year, and any increase seems unlikely, at least until the Mississippi Valley is in normal shape again.

In Europe and especially in England the outlook seems to be improving except as it may be affected by conditions in the Far East. Great Britain in particular is much more cheerful, and John Bull is unusually optimistic.

In this country there is nothing to be apprehensive about, but as the summer approaches it becomes clearer that we reached the peak of our present prosperity some months ago and that 1927 is likely to see a *diminuendo* movement that will continue at least until we commence to sell the year's crops and the unwarranted distension in the stock market has been reduced. In the interval rational caution and circumspection will be wise.

WHAT'S DOING IN INDUSTRY

PROSPECTS of increased business in the machinery and machine tool market during the month of May are not as bright as they appeared from earlier signs. There has been a falling off in general activity in many of the important industrial centers, and while there is a fair volume of hand-to-mouth buying of special tools, little is being done in the way of lists.

THE SOUTH offers an optimistic view, improvements in manufacturing and construction lines has served to enliven sales of machinery. New England is behind the average of previous months, but there is considerable business in prospect. Sales in New York are desultory and the volume of inquiries is only fair. Canada reports large buying tapering off, but steel and construction projects are keeping up a volume of small lot buying. Sales are rather sluggish in Cincinnati, orders and inquiries being scattered and of small character. Chicago reports inactivity, with railroads the only buyers of any consequence. In Indianapolis an extensive program of highway construction and public utility work is furnishing a good market for certain types of machinery.

THERE is nothing apprehensive about the general business situation, although rational caution and circumspection are being advocated by many students of present conditions.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CANADA

While buying on a large scale is beginning to taper off, most metal working plants in Canada are fairly well stocked with business for the next few months, and there is prospect of a continuance of small lot buying. Automotive production is holding its own, agricultural implement plants are busy and foundries are reporting capacity operation in many instances.

The demand for mining machinery and equipment is brisk. One large mine in the Rouyn district of Quebec recently placed an order for nearly $100,000 worth of machine tools. The Dominion Foundries and Steel Co. announces orders on hand sufficient for the next two or three months, and good prospects for a busy year. The Toronto Foundry Co. reports business good in the jobbing line. The Ottawa Car Manufacturing Co. is working on an order of twenty new street cars for the Ottawa Electric Railway Co.

Business is considerably more active than at this time last year, especially in the provinces of British Columbia, Ontario and Quebec, with a consequent increase in demand for builders' hardware and structural steel. Iron and steel production was higher in March. The output of pig iron at 75,637 long tons showed a gain of almost 50 per cent over February. Production of steel ingots and castings advanced to 107,381 tons in March, a gain of 93 per cent over the output of 55,620 tons in February.

NEW ENGLAND

Orders booked during the past week were not up to the average generally prevailing the first three months of the year, probably due to a feeling of pessimism; but so far as the leaders of the machinery industry in New England are concerned, a favorable outlook is entertained. The manufacturers of automotive products are those principally affected by a falling off in business and in many quarters this was attributed to contemplated changes in designs. Those connected with leaders of the industry, however, are not feeling any change and production at maximum is maintained.

The visit of the Australian commission occupied the attention of New England industrialists during the past week and hopeful views are entertained that impressions obtained through this visit will be productive of business later.

CINCINNATI

A sluggish market condition in the past week is reported by machine tool manufacturers in the Cincinnati district. Dealers state that by hard work they have kept up sales to a satisfactory volume and avoided a falling off. Many of the orders received called for rush shipments, showing that there still is a tendency to defer buying until the purchase becomes imperative. Selling agents report that in spite of the present sales resistance and the general inclination to defer buying they are doing a fair business.

The greater portion of the week's business consisted of orders for single tools and replacements. A few scattered orders came from railroads and from concerns in the automotive industry.

The majority of manufacturers and selling agents report that a fair volume of diversified inquiries came in during the past week. There were very few lists, however, and the great majority of the inquiries were in regard to single tools.

Manufacturers and selling agents are optimistic, and they join in the prediction that an increased volume of business will develop in the next few weeks. Production is normal and factories have sufficient orders booked to keep them busy.

SOUTHERN DISTRICT

Machinery and equipment sales continue to show improvement in the Southeast, and though not yet quite as large as they were at this time last year, should sales continue the same rate of improvement the next two weeks, by the middle of May they will be equally as large as they were in 1926.

There is a brisk demand reported for road building machinery, with the volume fully up to last year, and a better than normal season is in prospect as various states are carrying out road building and maintenance programs this year. The sale of building equipment and contractors' supplies, however, is still below last year, but as construction is beginning to take on more activity there is promise of steady improvement from now on. It is hardly thought, however, that the season will be as large as 1926 due to the lack of demand the first four months of this year.

Garage equipment sales continue to run less than last season, but are close to normal. Smaller machine shops are buying little at this time. Used or rebuilt equipment represents the primary wants in both these fields, comparatively few orders being reported for new equipment.

Textile sales have been improving steadily because of the large amount of new mill construction going on in this section, and a better than normal season seems to be in prospect for this reason. Railroad orders also continue to show improvement. Sales of heavier equipment in this field are now reported close to normal.

NEW YORK

The first week of a new month offers little in the way of improvement in the machinery and machine tool market in this territory. Sales are desultory, and inquiries are few and of small character. Business at this time is confined to purchases of single tools, some of which have been under consideration for several weeks. The absence of large lists from railroads and industrialists makes the market rather inactive.

Some good business is reported by dealers in drills, riveting machines and sheet metal working machinery. The large amount of industrial building and subway construction has provided a good market for that type of equipment used by building contractors.

Dealers report that greater sales effort is needed today to show a fair volume of sales. Competition in certain lines of standard tools is said to be keener now than for many months.

Orders placed in the past week included one from the Chicago, Rock Island & Pacific, the Stacy-Smith Co., Breckenridge Machine Co., Victor Talking Machine Co., General Electric Co., and the International Motor Co. Sales of lathes, grinders, die sinkers and bench tools were also made.

INDIANAPOLIS

Buying in this territory continues on a hand to mouth basis. Sales are fairly steady and the inquiries being received are encouraging. This is particularly true among the manufacturers and dealers of special contractors' equipment. Work is being started on the extensive road building program of the state highway department and many of the larger counties of the state and hundreds of miles of contracts have been let.

Another bright spot in the trade is the demand coming in for garage equipment, particularly in the smaller machinery line.

Railroad demand here remains rather quiet, though the volume of inquiry is increasing. Other utilities, particularly gas, interurban and power, are in the market rather extensively. Local machinery men believe the interurbans in this section will do much more replacing and make more extensions this year than last.

Some demand is coming from foundries, both iron and brass, and these factories generally are reported to be in a solid condition. The structural steel fabricating plants in the state also are making some purchases, but the volume is hardly as great as it was last year.

CHICAGO

Inactivity characterizes the present situation of the machine tool market. With an occasional exception, reports from dealers and manufacturers' representatives are to the effect that the actual business being done is disappointing compared with what had been looked for in April.

Inquiries are reported to be numerous, but there seems to be a disposition among those inquiring to defer closing as long as possible. It is largely the expectation of sales to prospective buyers being realized within a reasonable period that preserves such optimism as is indicated. Railroads continue to be the principal buying factors, industrial demand having decreased within the last few weeks. The Union Pacific and the Santa Fe roads have added some tools to their recent lists. The Rock Island is in the market for small lots. Inquiries have been received from the Studebaker Corporation for new equipment.

Demand for used tools is quiet. As compared with business for the first four months of 1926, inquiry among machinery houses elicits the information that there is a falling off in business this year.

DETROIT

The machinery and machine tool market in Detroit has come to a standstill this week. Two weeks ago and even last week there was prevalent a decided note of optimism, but this week the general machinery market is unusually tight. There are some orders for special machinery and some few inquiries. The Ford Motor Co. has made no announcement of its plans and the many rumors are still unconfirmed. The General Motors plants are all carrying forward their production plans but no changes in design have been made known.

Plan Technical Museums Throughout Country

A national network of technical museums, with an $8,000,000 center in Washington as the nucleus, was proposed at a meeting of leading engineers on April 28 in the Engineers Club New York.

The Government will be asked to provide ground for the central museum in Washington, which will be associated with the Smithsonian Institute. The building would cost $4,500,000 and the endowment would approximate $3,500,000. A fund of $2,000,000 also is sought for equipping in part the branch museums throughout the country.

Of the total, $1,000,000 already has been pledged, leaving $9,000,000 to be raised by popular subscription. Most of the gifts will come, it is expected, from engineering groups and industrial concerns.

An executive meeting followed the luncheon and these trustees were elected: L. P. Alford, B. C. Batcheller, George M. Pond, Nicholas F. Brady, Mr. Bushnell, Fred H. Colvin, James Craig, Thomas Ewing, F. A. Halsey, Mr. Hooper, Professor D. C. Jackson, Joseph Keller, Fred R. Low, H. P. Merriam, Mr. Porter, Dr. M. I. Pupin, Dr. Elmer A. Sperry, Kirby Thomas and F. A. Waldron.

Taylor Society

The annual spring meeting of the Taylor Society will be held in Washington, D. C., on May 9 and 10. The sessions will be held in the rooms of the National Research Council, and the headquarters will be in the Hotel Powhatan. The general topic of the discussions will be "Leadership," and one of the principal addresses will be "The Army's Contribution to the Understanding of Leadership and Its Development," by Gen. M. B. Stewart, superintendent of the U. S. Military Academy at West Point.

Two symposiums will be held during the meeting, one on the development of leadership and one on the principles, methods and techniques of studying leaders. The annual dinner will be held in Hotel Powhatan on Monday evening.

Air-Cooled Engine Plane Makes Record Flight

Aeronautical engineers hailed as a revolutionary step in the advancement of naval aviation the successful trial flight of a huge single-motor, air-cooled bombing plane constructed by the Glenn L. Martin Airplane Co.

The great ship, largest bomber of its type in the world, took off from the Glen L. Martin field in Cleveland last week, and soared for twenty minutes, the first time in history that any military plane had carried a load greater than its own weight. Both the take-off and the landing were described by observers as perfect.

The flight was the first test of the Pratt & Whitney 525-hp. radial motor developed especially for naval bombing planes, and the trial was observed by a group of naval experts and aeronautical engineers who have been in close touch with its construction. As the great ship took off Glen L. Martin, president of the company bearing his name, declared that if successful the flight would render "virtually obsolete all bombing planes equipped with water-cooled motors."

The ship embraces what aeronautical engineers declared an "almost revolutionary" frame construction, which cuts its weight fully 25 per cent, with no lessening of strength.

Fisher Elected President of Jones & Laughlin

Charles A. Fisher, whose entire business career has been with the Jones & Laughlin Steel Corporation, was made president of that corporation at the annual meeting of stockholders on April 26. He fills the vacancy caused by the death of William Larimer Jones.

Mr. Fisher has been vice-president in charge of finance since the creation of the present corporation in 1923. B. F. Jones, 3rd, a grandson of the late

Charles A. Fisher

B. F. Jones who founded the business in 1850, was made vice-president and secretary. He has been secretary since the formation of the present corporation. T. M. Girdler, vice-president in charge of operation, was made a member of the executive committee. B. F. Jones, Jr., chairman of the board of directors, and all other officers and directors were re-elected.

Columbus Steel Treaters

A new chapter of the American Society for Steel Treating was formed last week at Columbus, Ohio. Seventy-five prospective members attended the organization meeting, which was called by J. O. Lord, of Ohio State University. G. S. McFarland, consulting engineer, of Columbus, was elected chairman of the group for the year. S. Z. Krumm, of the Buckeye Steel Castings Co., was elected vice-chairman.

American Welding Society Reviews Progress

The annual meeting of the American Welding Society was held on April 27, 28 and 29, at the Engineers' Club, New York. On Wednesday morning the gas welding committee, of which S. W. Miller is chairman, reviewed progress and made suggestions for future research. Later during the morning the electric arc welding committee, H. M. Hobart chairman, analyzed and discussed the results of tests made by the Emergency Fleet Corporation in connection with the art. In the afternoon there was a meeting of the American Bureau of Welding at which C. A. Adams, director, presided. Research work of the committee was reviewed, plans laid for future investigation, and officers elected.

Thursday morning E. H. Ewertz presided at a symposium of research activities during the past three years. Following a luncheon at the Engineers' Club, the technical session was resumed, E. M. T. Ryder presiding. Papers were presented, including: "Production Welding of Stern Frames," by J. H. Deppeler, Metal and Thermit Corporation; "Replacing Castings by Welded Structural Parts," by J. F. Lincoln, Lincoln Electric Co.; "Application of Arc Welding to Houses and Buildings," by C. J. Holslag, Electric Arc Cutting and Welding Co.; "Oxy-acetylene Welding of Furniture," by M. F. Bayer, Simmons Co.; "Applications of Welding in Automobile Manufacture," by Robert Appleton, Pierce-Arrow Manufacturing Co.

Following the precedent of last year, a dinner dance was held at the Hotel Commodore in the evening. During the banquet an address was delivered by F. M. Farmer, president. The newly-elected officers were announced. These are: F. M. Farmer, president; J. H. Edwards, senior vice-president; R. L. Shepherd, Birmingham, Ala. and G. O. Wilson, San Francisco, divisional vice-presidents; J. J. Crowe, New York, N. Y.; W. H. Gibb, Bay City, Mich.; H. S. Smith, New York, N. Y.; W. C. Swift, West Alexandria, Ohio.

U. S. Engineers Honored

For eminent service to the Czechoslovak State, six American engineers have received the Cross of Knight of the Czechoslovak Order of the White Lion. They are: Prof. Joseph W. Roe, head of the Department of Industrial Engineering in New York University; Calvin W. Rice, New York, secretary of the American Society of Mechanical Engineers; Alfred D. Flinn, New York, director of the Engineering Foundation; Lawrence W. Wallace, Washington, executive secretary of the American Engineering Council; H. S. Person, New York, managing director of the Taylor Society; Morris L. Cooke, industrial engineer, of Philadelphia.

The order was created "in accordance with the approval of the President of the Republic as decoration for citizens of foreign states in appreciation of their services rendered on behalf of the Czechoslovak State."

Personals

H. B. NEWELL has been elected vice-president of the Fawcus Machine Co., of Pittsburgh.

A. C. NIEMAN has been appointed factory representative in Cleveland for the Kempsmith Manufacturing Co., of Milwaukee.

W. T. TEAGUE has been designated to succeed J. L. Kilpatrick as vice-president of the Western Electric Co.

A. H. CLARKE has resigned as general sales manager of the Combustion Engineering Corporation, Ltd., Montreal.

CLARENCE M. WOOLLEY, chairman of the board of the American Radiator Co., has been elected a member of the board of directors of the General Electric Co.

HUGH PURDY, managaing director of Buck & Hickman, Ltd., London, England, has returned to England after a short business trip to the United States.

H. C. THOMAS has been appointed assistant general manager of the merchandising department of the Westinghouse Electric and Manufacturing Co.

LEITH MURRAY has been appointed representative at Vancouver, B. C., for the Bethlehem Steel Co. He will handle the sale of Bethlehem products in Western Canada.

H. M. THOMPSON, formerly chief mechanical engineer for Sawyer-Massey Ltd., Hamilton, Ontario, is now designing draftsman for John Fowler, Ltd., Leeds, England.

FRED E. HOLTZ has been appointed representative in the Milwaukee territory by the William Ganschow Co., of Chicago. The division headquarters will be at 1246 24th Ave.

CHARLES O. WATSON, formerly branch manager in Buffalo for Manning, Maxwell & Moore, Inc., of New York, has been appointed direct factory representative east of Pittsburgh, for the Kempsmith Manufacturing Co., of Milwaukee.

ROYAL D. MALM has been appointed Western district sales manager for the Lincoln Electric Co., of Cleveland. He will make his headquarters in Chicago. Recently Mr. Malm has been in charge of Lincoln automotive sales in the Detroit territory.

W. H. PATTERSON, formerly assistant industrial sales manager of the Westinghouse Electric and Manufacturing Co., has been appointed district manager of the Kaestner & Hecht Co., with offices in the Chamber of Commerce Building, Pittsburgh. This company is a subsidiary of Westinghouse.

W. O. FORMAN, until recently mechanical superintendent of the Boston & Maine R.R., has entered the service of Manning, Maxwell & Moore, Inc., as assistant to vice-president, Frank J. Baumis. For the present he will specialize in factory operations and methods at the Putnam and Shaw factories of Manning, Maxwell & Moore, Inc.

ROSS L. MCLELLAN, formerly managing director of Cia. Westinghouse Electric Internacional, S. A., has been appointed general manager of the Westinghouse International Co., with headquarters in New York. Mr. McLellan arrived in New York recently from Buenos Aires and immediately assumed his new position.

Business Items

Barker & Wheeler, consulting engineers, announce the removal of their New York offices from West St. to 9-15 Park Place.

The Bridgeport Metal Goods Co., of Bridgeport, Conn., is having plans prepared for a new two-story factory building.

H. O. Swoboda, Inc., of Pittsburgh, manufacturer of electric heat-treating apparatus, has moved to 3400 Forbes St., in that city.

The American Oven & Machine Co., of Chicago, announces the removal of its general offices and factory to a new plant at 615 S. Carolina Ave., in that city.

The Eclipse Machine Co., of Elmira, N. Y., manufacturer of aircraft equipment, has leased a part of the plant of the A. P. Smith Manufacturing Co., in Bloomfield, N. J.

The Stanley Works is moving its metal stamping department from the American Tube and Stamping Co.'s plant in Bridgeport, Conn., to New Britain, Conn.

The Brown Instrument Co., of Philadelphia, announces the opening of a branch office at 718 First National Bank Bldg., Cincinnati. J. R. Green is district manager.

The American Brass Co., of New York, has opened a branch office in the Military Park Bldg., Newark, N. J. At the present time J. B. Benedict and L. B. Smith are in charge.

The Fairchild Lock Co. of New Haven, Conn., has bought the Rowe Calk and Chain Co. plant at Southington, Conn., taking possession at once. The Fairchild Co. manufactures a patented locking device for automobiles.

The Lockwood Manufacturing Co., of South Norwalk, Conn., hardware manufacturer, is to build a two-story vault building at a cost of $20,000 for the preservation of jigs and dies. The building 30x30 ft., will be steel and reinforced concrete construction.

The Gammons-Holman Co. manufacturer of taper pin reamers, has purchased the factory building of Cheney Bros., South Manchester, Conn. This factory, will be used for production of the Gammons helical end mills and chucking reamers.

The York Ice and Machine Co. has been organized, being a merger of the York Manufacturing Co., manufacturer of ice making machinery, and several of its subsidiaries. The merger is said to have involved a total stock of twenty million dollars.

The Westinghouse Electric and Manufacturing Co., formally opened the new Westinghouse Bldg., in Wilkes-Barre, Pa., which is the first main office and service shop in this territory under the company's management. J. B. Parks is branch manager, and H. L. Huntley is service manager.

Braxelton, Wessendorf & Nelms, Inc., of 317 Preston Ave., Houston, Texas, have been appointed representatives in southwestern Texas for the Whiting Corporation, of Harvey, Ill. They will handle the complete line of cranes, foundry equipment and railroad supplies.

The Prest-O-Lite Co. announces the sale of the storage battery branch of its business to a new company, the Prest-O-Lite Storage Battery Corporation. The entire capital stock of the purchasing company is owned by the Automotive Battery Corporation of New York. That portion of the Indianapolis plant of the Prest-O-Lite Co., Inc., used for the manufacture of storage batteries has been leased to the new company. The Prest-O-Lite Co., Inc., while discontinuing the battery branch of its business, will continue the manufacture and sale of acetylene gas for use in welding and cutting metals, automobile lighting, lead burning, etc. The Prest-O-Lite Co., Inc., will also continue operation of that portion of its Indianapolis plant devoted to the manufacture of gas cylinders, acetylene generators and other apparatus.

Obituaries

W. G. HASKELL, president of the Johnson Gas Appliance Co., of Cedar Rapids, Iowa, died on April 17 at his home in that city.

MAX J. GERSON, president of the Southern Steel and Rolling Mill Co., of Birmingham, Ala., was killed recently when he accidentally fell from the observation car of a passenger train near Lincoln, Ala. Mr. Gerson was 43 years of age, and had been identified for several years with the iron and steel industries in the Southeast.

HENRY H. CURTIS, secretary and treasurer of the C. & P. Electric Works, Inc., of Springfield, Mass., died at his home in that city on April 28. He was 58 years old. Mr. Curtis had been active in the electrical manufacturing industry for more than thirty years and was the founder of the C. & P. company.

Forthcoming Meetings

American Gear Manufacturers Association. Eleventh annual meeting, Hayes Hotel, Jackson, Mich., May 12 to 14. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Society for Steel Treating. Spring sectional meeting, Milwaukee, Wis., May 19 and 20. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Society of Mechanical Engineers. Semi-annual meeting, White Sulphur Springs, W. Va., May 23 to 26. C. E. Davies, secretary in charge of meetings, 29 West 39th St., New York.

Associated Machine Tool Dealers. Annual spring meeting at Granville, Ohio, May 25, 26 and 27. Tyler W. Carlisle, secretary, the Strong, Carlisle & Hammond Co., 1392 West Third St., Cleveland, Ohio.

National Foreign Trade Council. Fourteenth national foreign trade convention, Hotel Statler, Detroit, Mich., May 25, 26 and 27. O. K. Davis, secretary, India House, Hanover Square, New York.

Society of Industrial Engineers. Annual meeting, Hotel Stevens, Chicago, May 25, 26 and 27. George C. Dent, secretary, 608 S. Dearborn St., Chicago, Ill.

Society of Automotive Engineers. Summer meeting, French Lick Springs, Ind., May 25 to 28. C. E. Heywood, manager of meetings department, 29 W. 39th St., New York City.

American Foundrymen's Association. Annual convention, Edgewater Beach, Chicago, June 6 to 10. R. E. Kennedy, secretary, 909 W. California St., Urbana, Ill.

National Supply and Machinery Distributors' Association. Twenty-second annual convention with the **Southern Supply and Machinery Dealers' Association**, and the **American Supply and Machinery Manufacturers' Association**, on board the steamship *Noronic*. Boat leaves Detroit, Mich., June 13 and returns there June 17. George A. Fernley, secretary, 505 Arch St., Philadelphia.

Exposition of Engineering Developments. Under the auspices of the Association of Iron and Steel Electrical Engineers, in the Empire Bldg., Pittsburgh, June 13 to 18. John F. Kelly, general chairman, 705 Empire Bldg., Pittsburgh.

American Society for Testing Materials. Annual meeting at French Lick, Ind., June 20 to 24. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia.

American Railway Tool Foremen's Association. Fifteenth annual meeting, Hotel Sherman, Chicago, Aug. 31, Sept. 1 and 2. G. G. Macina, secretary, 11,402 Calumet Ave., Chicago.

Machine Tool Exhibit. Seventh annual machine tool exhibition under the auspices of the New Haven Section of the American Society of Mechanical Engineers, the Department of Mechanical Engineering of Sheffield Scientific School, Yale University, and the Chamber of Commerce of New Haven: At the Mason Laboratory, Yale University, Sept. 6 to 9. Harry R. Westcott, chairman of the exhibit committee, 400 Temple St., New Haven, Conn.

American Society for Steel Treating. Ninth annual convention and national steel exposition, Detroit, week of Sept. 19. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland.

Machine Tool Builders' Exposition. First annual machine tool exposition, conducted by the National Machine Tool Builders' Association, at the West Annex of the Public Auditorium, Cleveland, Ohio, Sept. 19 to 24. J. Wallace Carrel, vice-president and general manager, the Lodge & Shipley Machine Tool Co., Cincinnati, chairman of the exposition committee. Roberts Everett, manager of the exposition, 225 West 34th St., New York. Ernest F. DuBrul, general manager of the association, 826 Provident Bank Bldg., Cincinnati, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

THE apparent easing-up in current demand for shop materials used in the metal working industries, is probably nothing more than a seasonal movement. Pig iron is quiet, while scrap prices continue to sag. Railway materials are not as active as they were a few weeks back. Ample reserves of steel ingots have been stored against an emergency, arising out of the present coal strike, at the same time, Mississippi floods retard steel buying. Practically everything on the non-ferrous list is quieter this week, with downward price tendencies, excepting possibly, paint materials and copper wire.

(All prices as of Apr. 29)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$22.19
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	26.37
BIRMINGHAM	
No. 2 Foundry	18.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.76
Virginia No. 2	27 17
Basic	21.76
CHICAGO	
No. 2 Foundry local	21.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	23.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.76
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.00@4.50
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	4.75@5.25

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.20@2.30	3.50	3.25	3.89
No. 12	2.25@2.35	3.55	3.30	3.94
No. 14	2.30@2.40	3.60	3.35	3.99
No. 16	2.40@2.50	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.50@2.60	3.75	3.25	4.00
No. 22	2.65@2.75	3.90	3.40	4.15
No. 24	2.70@2.80	3.95	3.45	4.20
No. 26	2.80@2.90	4.05	3.55	4.30
No. 28	2.95@3.05	4.20	4.70	4.45
Galvanized				
No. 10	2.95@3.00	4.10	3.95	4.25
Nos. 12 to 14	3.05@3.10	4.20	4.05	4.35
No. 16	3.15@3.20	4.30	4.15	4.45
No. 18	3.30@3.35	4.45	4.30	4.60
No. 20	3.45@3.50	4.60	4.45	4.75
No. 22	3.50@3.55	4.65	4.50	4.80
No. 24	3.65@3.70	4.80	4.65	4.95
No. 26	3.85@3.90	5.05	4.90	5.20
No. 28	4.10@4.15	5.30	5.15	5.45

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv
1 to 3 in. steel butt welded.	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded.	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft. or 100 lb.:

Thickness — Decimal	B.w.g. and Fractions	Outside Diameter in Inches ¼	⅜	½	⅝	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	....	4.65
Spring steel, heavier	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (2.75 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, ⅛, 8.35c.; ¼, 7.85c.; ⅛ to ½, 7.35c. per lb. *Flat, ⅛@¼-in. thick.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic, up to carlots, New York			14.37½
Tin, pigs, 5-ton lots, New York			68.50
Lead, pigs, up to carlots, E. St. Louis	6.50	New York	7.50
Zinc, slabs, up to carlots, E. St. Louis	6.12½	New York	7.00

	New York	Cleveland	Chicago
Antimony, slabs, ton spot	17.00	.....	15.00
Copper sheets, base	21.75	21.75	21.75
Copper wire, base	18.62½	18.37½	18.50
Copper bars, base	21.37½	21.37½	21.37½
Copper tubing, base	23.75	23.25	23.75
Brass sheets, high, base	18.12½	18.12½	18.12½
Brass tubing, high, base	23.00	23.00	23.00
Brass rods, high, base	15.87½	15.87½	15.87½
Brass wire, high, base	18.62½	18.37½	18.62½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	26.00	26@27	26.02
Zinc sheets (casks)	11.25	12.30	11.36
Solder (½ and ½), (case lots)	41.50	43.75	38½@42½
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade			85.00
Commercial genuine, intermediate grade			61.00
Anti-friction metal, general service			31.50
No. 4 babbitt (f.o.b.)			13.25
Nickel, f.o.b. refinery, cents per lb.:			
Ingots 35.00 Electrolytic 39.00		Shot	36.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.50 @11.75	10.75	10.25 @10.75
Copper, heavy, and wire	10.75 @11.25	11.00	9.50@10.00
Copper, light, and bottoms	9.25 @ 9.75	9.50	8.50@ 9.00
Heavy lead	5.75 @ 6.00	6.25	5.50@ 6.00
Tea lead	4.37½@ 4.62½	4.25	4.25@ 4.75
Brass, heavy, yellow	7.25 @ 7.50	7.50	6.50@ 7.00
Brass, heavy, red	9.25 @ 9.50	9.50	8.75@ 9.25
Brass, light	5.50 @ 5.75	6.00	5.75@ 6.25
No. 1 yellow rod turnings	7.50 @ 8.00	7.50	6.75@ 7.25
Zinc	4.00 @ 4.25	4.00	3.00@ 3.50

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13½	$0.16	$0.15@0.20
Cotton waste, colored, per lb.	.09@ .13	.12	.12@.17
Wiping cloths, washed white, per lb	.15½	36.00 per M	.15
Sal soda, per lb	.02½	.02	.02½
Roll sulphur, per lb	.02½	.03½	.04
Linseed oil, raw, per 7½-lb. gal., 5 bbl. lots	.85½	.93	.85
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	.55	.50	.50
Machine oil, medium-bodied (55 gal. metal bbl.), per gal.	.33	.35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb	.04	.04	.04
Brass rods	per lb	.1587½	.1612½	.1662½
Solder (½ and ½)	per lb	.415	.42	.4012½
Cotton waste, white	per lb	.10@13½	.10@.13½	.13@.17½
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.55
Lard cutting oil	per gal	.55	.55	.55
Machine oil	per gal	.33	.33	.35
Belting, leather, medium	off list	40–5%	40–5%	40–5%
Machine bolts, up to 1x30 in., full kegs	off list	50%*	40%	40%

*New list April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
*Flint paper	$5.13	$4.95	$5.13
*Emery paper	10.71	9.15	10.71
*Emery cloth	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.29	1.27	1.32
Cloth	3.10	3.05	3.05
Fire clay, per 100 lb. bag		.75	.75
Coke, prompt furnace, per net ton		Connellsville,	3.15@3.25
Coke, prompt foundry, per net ton		Connellsville,	4.00@4.50
White lead, dry or in oil	100 lb. kegs		New York, 15.25
Red lead, dry	100 lb. kegs		New York, 15.25
Red lead, in oil	100 lb. kegs		New York, 16 75

*4½ reams and under.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Broken Kegs or Cases	Full Kegs or Cases
Machine bolts, square heads and nuts:		
Up to ¾ x 6-in	50%	50–10%
Larger up to 1 x 30-in	45%	50%
1¼ and 1½ in. dia	30%	35%
Carriage bolts:		
Up to ½ x 6-in	50–10%	
Larger sizes	50%	
Coach and lag screws:		
Up to ½ x 6-in	50–10%	
Larger sizes	50%	
Tap bolts, hexagonal heads	45%	
Nuts:		
Hot pressed, square and hexagonal, blank or tapped	45%	50–10%
Cold punched, square and hexagonal, blank or tapped	45%	50–10%
Semi-finished, hexagonal, tapped, in packages	40%	
Case hardened, hexagonal, tapped, in packages	30%	
Washers: Deduct from list, per 100 lb	$1.50	$3.50
Rivets, button and cone head:		
Small, including ⅛-in. dia		50–10%
Large (base) per 100 lb	$6.50	$5.00

EXTRA per 100 lb. on rivets, for ¼-in. dia., 35c.; ⅜-in., 15c.; 1-in., 5c.; lengths 1-in. and shorter, 25c.; longer than 1-in. up to and including 1¼-in., 15c. longer than 5-in., 25c.; standard countersunk head, 25c.

Machine Requirements and Industrial Construction

Equipment Wanted

Calif., San Francisco—Standard Box Co., Beale and Bryant Sts.—machinery to exceed $25,000 to replace fire loss.

Mass., Wellesley (Boston P.O.)—J. E. Lee, 562 Washington St.—miscellaneous tools and equipment for proposed repair and service garage. Estimated cost $75,000.

Mich., Detroit—Briggs Mfg. Co., Mack Ave.—complete equipment for body finishing for proposed 5 story, 105 x 1050 ft. auto body factory recently destroyed by fire.

N. J., Newark—Bd. of Education will receive bids until May 11 for woodworking equipment, etc.

N. J., New Brunswick—Mohme Aero Engineering Co., c/o W. E. Arthur, 103 Park Ave., New York, Archt. and Engr.—metal and wood working equipment, lathes, etc. for proposed factory.

O., St. Marys—The Quickwork Co.—rotary shear, No. 60.

Tex., San Benito—D. C. Raybourn, c/o Chamber of Commerce—complete machinery and equipment, electrically operated, for proposed planing mill.

Tex., Sweetwater—Star Foundry Steel & Machine Co., c/o A. A. Koch, San Angelo—complete equipment for the manufacture of spudders, hammers, etc. for proposed foundry near here. Estimated cost $75,000.

Alta., Calgary—Riverside Iron Works Ltd., F. L. Irving, Purch. Agt.—two machinists lathes and one 3 ton electric traveling crane, 30 ft. span.

Alta., Calgary—George Stewart & Co., 216 Ninth Ave. E.—several power lathes and hoisting engines.

B. C., Vancouver—J. L. Bain, 871 Pender St. E.—lathes.

B. C., Vancouver—Murray-Latta Machine Co. Ltd., 619 Bidwell St., R. B. Ellis, Purch. Agt.—general equipment for machine shop.

Ont., Collingwood—Barron Oil Burners Co.—machinery and equipment for the manufacture of oil burners for recently acquired factory. Estimated cost $50,000.

Ont., Vittoria—F. Butler—prices and catalogs on complete equipment for saw and planing mills to replace fire loss. Estimated cost $30,000.

Mexico, Nuevo Laredo—C. M. Flato, Monterrey, c/o Chamber of Commerce, Laredo, Tex.—machinery and equipment for the manufacture of furniture for proposed factory here. Estimated cost $100,000.

Opportunities for Future Business

Calif., Los Angeles—Bd. of Education, is having preliminary plans prepared for the construction of a shop, etc. at Belmont High School. Estimated cost $160,000.

Calif., Los Angeles—Truscon Steel Co., 1480 East 4th St., manufacturers of steel products, has acquired a site and plans the construction of first unit of factory, 60 x 250 ft., on Slauson Ave.

Calif., Los Angeles—Tucker & Regan, Mutual Bldg., had plans prepared for the construction of a 1 and 2 story, 200 x 300 ft. factory and garage at Washington and Alameda Sts. Estimated cost $40,000. Title Holding Co., Chapman Bldg., Archt. W. E. Young, Chapman Bldg., Engr. General Motors Co., 717 South San Pedro St., lessee.

Calif., San Diego—Bureau of Yards & Docks, Navy Dept., Washington, D. C., will receive bids until May 25 for the construction of a garage at Naval Operating Base here.

Calif., San Francisco—H. Harder, 1819 San Bruno Ave., is having plans prepared for the construction of a 2 story, 60 x 90 ft., planing mill, at Bay Shore Highway and Oakdale Ave. A. H. Larsen, 447 Sutter St., Archt.

Calif., San Francisco — Metropolitan Furniture Co., 1017 Folsom St., awarded contract for the construction of a 2 story factory on 7th St. Estimated cst $42,500.

Ill., Chicago—Chicago Machinery Mart Building, D. D. Meredith, 4750 Sheridan Rd., awarded contract for the construction of a 2 story, 149 x 340 ft. garage at 306-318 South Canal St. Estimated cost $300,000.

Ill., Chicago—Wisconsin Steel Works, 2701 East 106th St., awarded contract for the construction of a 40 x 60 ft. factory at 106th St. and Torrence Ave. Estimated cost $40,000.

Ind., Gary—N. Moswick, 117 West 5th St., awarded contract for the construction of a machine shop and garage. Estimated cost $40,000.

Ind., Hagerstown — Perfect Circle Co., manufacturers of piston rings, is having plans prepared for the construction of a 1 story factory. Estimated cost $40,000. Private plans.

Ind., Indianapolis—Sink & Edwards, 621 East Ohio St., manufacturers of furnaces, will soon award contract for the construction of a 2 story, 48 x 204 ft. factory. Estimated cost $45,000. W. H. Albersmier, 508 Rank Bldg., Archt.

Ind., Muncie—Western Oil Refining Co., 310 North Meridian St., Indianapolis, awarded contract for the construction of a 1 story, 28 x 102 ft. machine shop and service station here. Estimated cost $45,000.

Ind., Newcastle—Indiana Rolling Mills is having preliminary plans prepared for the construction of a factory. Estimated cost $40,000. Private plans.

Ind., Ft. Wayne—P. Doege, 2701 John St., awarded contract for the construction of a 2 story, 75 x 155 ft. garage and repair shop. Estimated cost $45,000. Noted Nov. 11, 1926.

Md., Baltimore—Anchor Post Iron Works, 9 East 38th St., New York, N. Y., plans the construction of a 1 story factory at Eastern Ave. and 35th St. here. Estimated cost $200,000 Architect and engineer not selected.

Mass., Lawrence—Emerson Mfg. Co., Market St., manufacturers of pulp and paper mill machinery, will soon award contract for the construction of a 1 story, 50 x 220 ft., factory on Market St. Estimated cost $40,000. Ashton, Huntress & Alter, 477 Essex St., Archts.

Mass., Watertown (Boston P. O.)—O. Theurer, 171 Watertown St., will build a 1 story, 80 x 100 ft. garage and repair shop at Arsenal and Taylor Sts. Estimated cost $45,000. Private plans.

Mich., Detroit—A. Kahn, 1000 Marquette Bldg., Archt., will receive bids about May 10 for the construction of a 5 story, 105 x 1050 ft. factory for the manufacture of auto bodies for Briggs Mfg. Co., Mack Ave.

Mo., St. Louis—Bd. of Public Service, c/o J. Pritchard, Dir., 208 City Hall, will receive bids until May 31 for a 3 story garage and repair shop, etc. on Clark Ave. for Fire Dept. Estimated cost $825,000. Study & Farrar, Arcade Bldg., Archts.

Mo., St. Louis — Hotel Kitchen Equipment Co., 915 Market St., awarded contract for the construction of a 3 story factory at Morgan and 13th Sts. Estimated cost $50,000.

N. Y., Lockport—Harrison Radiator Co., plans the construction of addition to factory on Washburn St. F. Voltaire, General Motors Bldg., Detroit, Mich., Archt.

N. Y., New York—Uppercu Cadillac Corp., 1881 Broadway, awarded contract for the construction of a 12 story garage and sales and service station at Columbus Ave. and 62nd to 63rd Sts. Estimated cost to exceed $1,000,000.

O., Alliance—American Steel Foundries Co., plans the construction of a 2 story, 50 x 80 ft. addition to factory on East Broadway. Estimated cost $50,000.

O., Canton—Canton Drop Forging & Mfg. Co., 300-400 Odd Row Pl., manufactures of drop forges, plans the construction of a 2 story addition to factory at 143 Willet Ave. S. E. Estimated cost $50,000.

O., Cincinnati—Cincinnati St. Railway Co., Dixie Terminal Bldg., will soon award contract for the construction of a 1 story car shop on Mitchell Ave. Estimated cost $600,000. H. Hake, 2400 Gilbert Ave., Archt.

O., Cleveland—Colonial Iron Works Co., 881 East 67th St., had plans prepared for the construction of a 1 story, 111 x 150 ft. fabricating shop at 17625 St. Clair Ave. Estimated cost $50,000. Private plans.

O., Cleveland—Lake Erie Iron Co., F. R. Scofield, Pres., B. F. Keith Bldg., awarded contract for the construction of a 1 story, 75 x 130 ft. machine shop at 971 East 63rd St. Estimated cost $40,000.

O., Columbus—Hoster Realty Co., 1 South Fourth St., is having plans prepared for the construction of a 2 story, 57 x 92 ft. repair and service garage. Estimated cost $50,000. Bassett & Treselt, 257 East Broad St., Archts. Noted Mar. 10.

O., Portsmouth — Howe Motor Co., awarded contract for the construction of a 2 story repair and service garage at Scioto Trail. Estimated cost $35,000.

Ore., Portland—R. D. Heinenway, Bedell Bldg., Archt., had plans prepared for the construction of a 2 story, 100 x 100 ft. garage, Montgomery St., for R. Somerville, 774 Halsey St. Estimated cost $150,000.

Pa., Philadelphia—American Container Co., Swanson and Shunt Sts., will soon award contract for the construction of a 5 story, 50 x 300 ft. factory at Swanson and Ribner Sts. A. B. Harding, Drexel Bldg., Engr.

Pa., Philadelphia—Crescent Box Co., D. and Erie Sts., plans the construction of a 2 story, 80 x 300 ft. factory. Ballinger Co., 12th and Chestnut Sts., Archt.

Tex., Beaumont — Boykin Machinery & Supply Co., Laurel and Second Sts., awarded contract for the construction of a 100 x 200 ft. foundry. Estimated cost $35,000.

Tex., San Benito—D. C. Raybourn, c/o Chamber of Commerce, is having plans prepared for the construction of a planing mill. Estimated cost $100,000. Private plans.

Virginia — Dunlop Creek Lumber Corp., Toledo, O., has acquired a site and plans the construction of a mill at Peter's Mountain near Covington and Clifton Forge here.

Wash., Bellingham — Bloedel - Donovan Lumber Mills, Henry Bldg., Seattle, plans the construction of a mill here.

Wis., Sturgeon Bay—Severson & Konrad, is having plans prepared for the construction of a 1 story, 80 x 100 ft. sales and service station on Garland St. Private plans.